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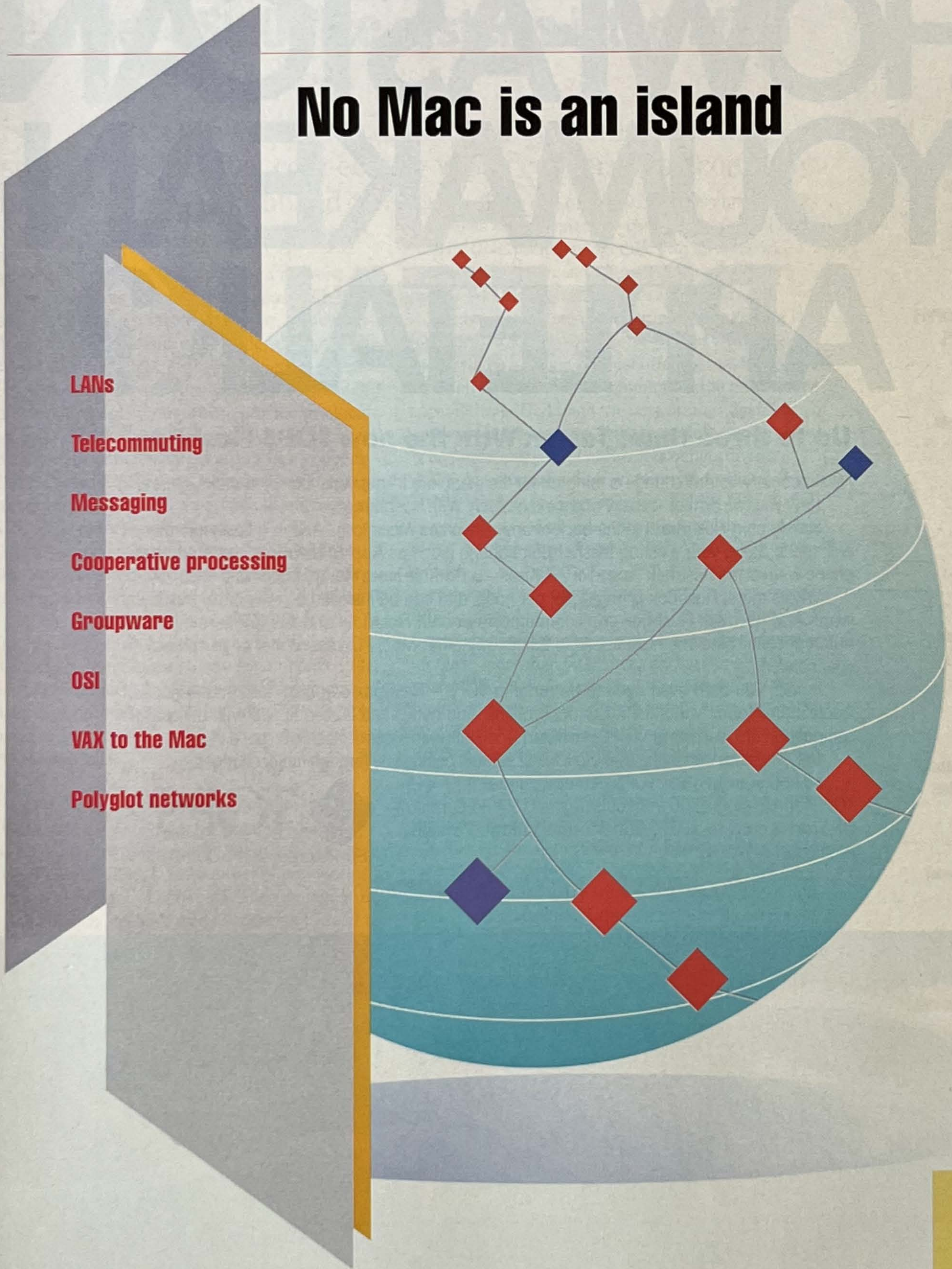

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MACINTOSH

GATEWAYS

The other OSI: Office systems integration

Commentary by Tom White

As one looks over Apple's announcements of the past year, it's clear that connectivity vitally concerns the company. John Sculley himself dubbed 1988 the "year of connectivity."

The flurry of product introductions and network strategy announcements culminated in August with the addition of IBM's Don Casey to head up Apple's network and communications product developments.

Closer examination of Apple's products and technologies, however, reveals the company's dependence on the development community to provide products that are acceptable to users. Apple started the year with a dramatic announcement of strategic cooperation with Digital Equipment Corp., designed to permit interconnection of Apple's workstations and networks to DEC's computers and networks.

The long-anticipated announcement of Apple-to-IBM mainframe connectivity via Advanced Program-to-Program Communications (APPC) followed shortly. Simultaneously, Apple introduced MacWorkstation, a toolkit that enables developers to access mainframe applications without having to give up the prized Macintosh user interface. Apple announced last month yet another internetworking product, MacTCP/IP, its version of the popular Transmission Control Protocol/Internet Protocols.

The right stuff. But Apple's strategy of supplying only the tools, gateways and interfaces to outsiders is a somewhat dangerous approach. Apple is in serious competition with IBM, DEC and Sun Microsystems to win the race for control of the office technologies of the 1990s. Much has been said concerning the right user presentation environment, the right workstation operating system and the right network system for the future. I believe, however, that the winners' laurels will go to those companies that offer not only consistent platforms but a coherent set of application products for the integration of office computing. IBM has already shared its vision. Its Systems Application Architecture has a strong component called SAA Office. This structure will provide for the migration of the already successful PROFS messaging system together with the fresh capabilities made possible by new operating system platforms. The application products will integrate electronic mail and personal productivity tools with work group and connectivity products.

Although IBM is also furnishing a set of toolkits and programming interfaces for developers to bring software to the market, such products will only enhance IBM's own offerings. DEC also understands the stakes of the game. The company is porting its ALL-IN-ONE package, together with its Network Application System and office application software products to the PC and PC network platforms.

Sun has not yet made a clear move concerning its long-term office systems strategy, but I anticipate there will be a strong product offering that integrates its Open Look user environment with the multi-user capabilities of UNIX and the networking capabilities of its Network File System (NFS) solution. Sun's recently acquired entry-level network products division, TOPS, has announced software products that will offer a number of groupware capabilities (see story, Page 8). It seems obvious that Sun regards a strong office systems presence as essential to its long-term success.

Office automation. In addition, we need to look at the dynamics of office networks. LANs are predicted to increase more than 60 percent during the next three years. This vital component of the connectivity scenario will be made up of workstations running PC/MS-DOS, OS/2, the Mac operating system and UNIX. Most networks will be composed of a variety of these workstations. Therefore, a number of vendors will be required to provide office computing products that span these operating systems.

What are the consequences if Apple doesn't change direction from an office workstation vendor that depends on third-party solutions to a provider of integrated office systems? I think that as large corporate customers begin moving their workstation purchases to those vendors able to supply their total office systems solution, Apple's penetration into the business market could peak within a few years.

Are there other options for Apple? I imagine so. Claris, its wholly owned software division, should make a serious move to enter the office automation products market. Claris has a brief history of offering remodeled versions of Macintosh standards. This could change if it moves aggressively to provide office computing capabilities in both the Macintosh and PC markets. Acquisitions and internal developments will further dilute Apple's reliance on third-party developers. As Claris gains experience in interconnectivity, it may prove to be the sleeping giant that Apple needs to retain its hard-won foothold in the office computing market. ●

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Novell presents a net even the pickiest

Macintosh owners have a reputation for being fanatical about their Macs. And rightfully so, when you consider the elegance of the Macintosh user interface.

So when Novell set out to network the Macintosh with PCs, it was with one clear caveat: preserve the Mac environment. Create network software that would feel right to the pickiest of all Macintosh users. And none are pickier than the ones at Apple.

Full AppleTalk compatibility. Working directly with Apple, Novell's programmers created a version of NetWare® that is compatible with the AppleTalk File Protocol (AFP). It's an achievement hailed by Apple President and CEO John Sculley as "a very significant event for the industry." And it means that Mac users can now get all the power and flexibility of the number one local area network in the world, without sacrificing any Macintosh functionality.

AFP compatibility also means that NetWare for Macintosh will be fully compatible with future Macintosh hardware and operating system versions. So you can take advantage of new Macintosh product releases as soon as they become available.

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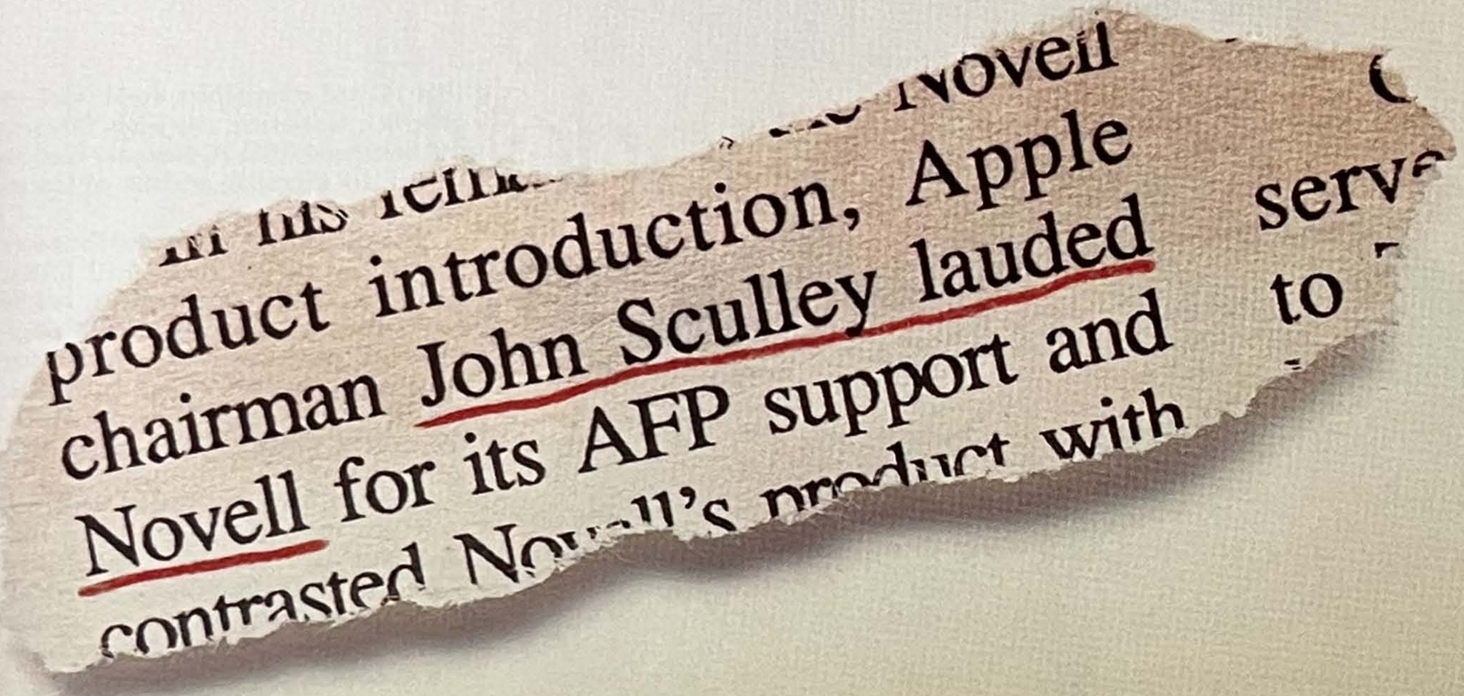

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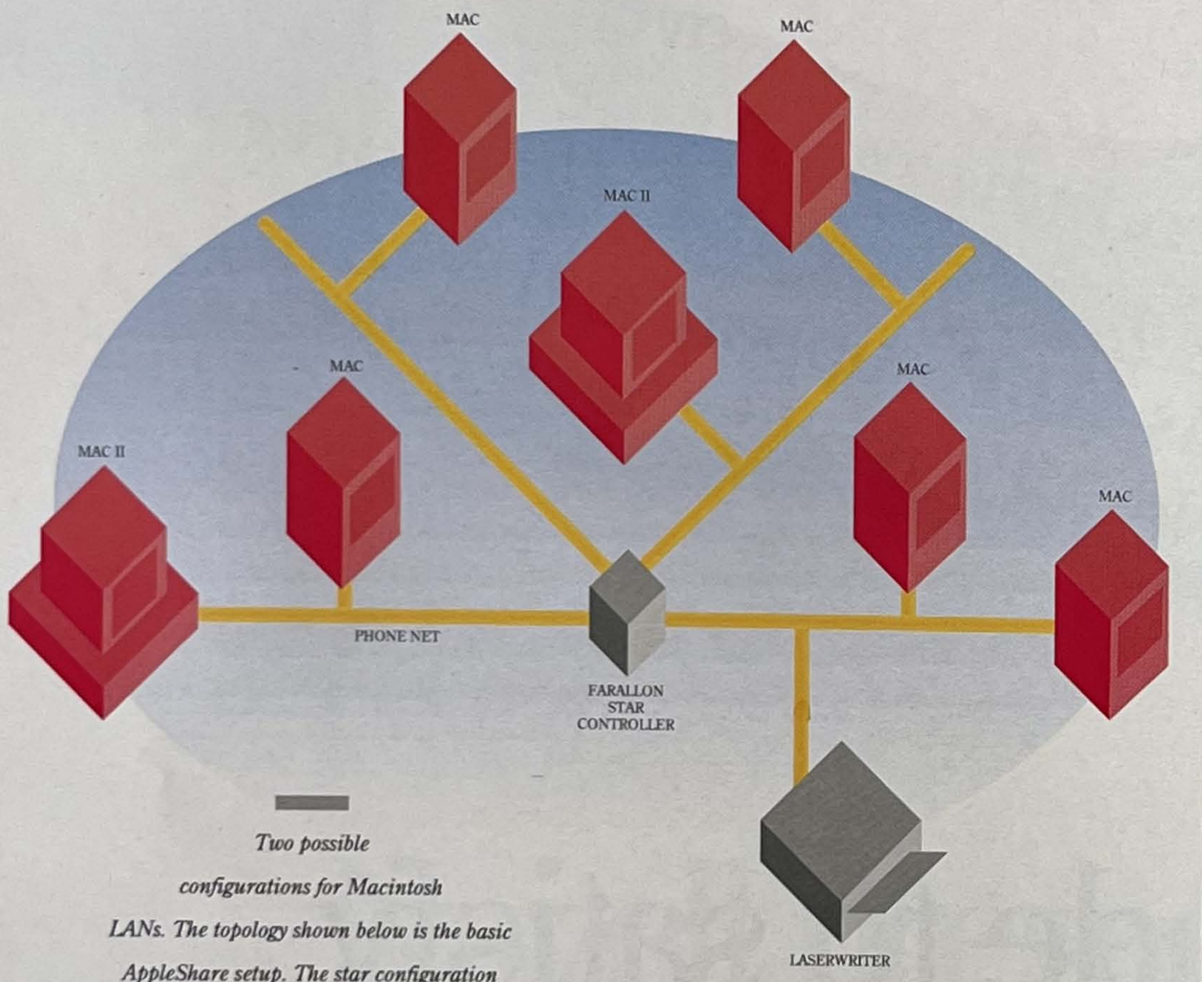
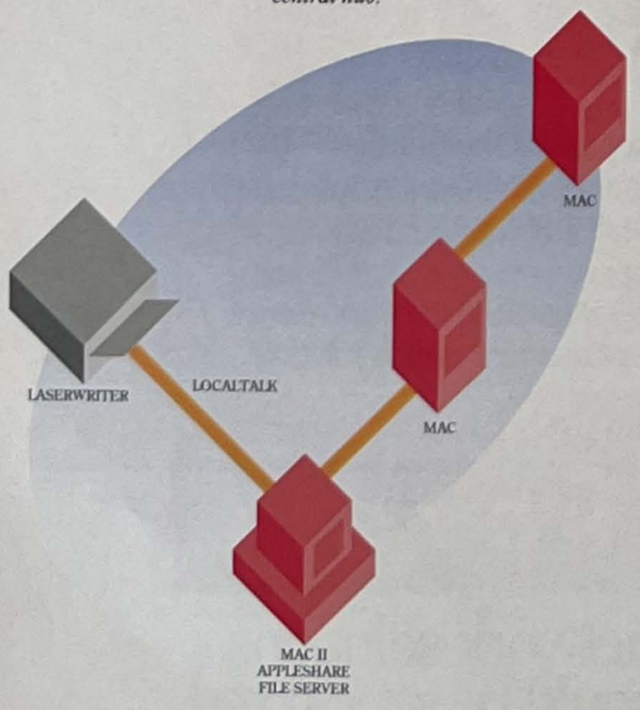
Mac to the LAN

By Jonathan Oski

Macintosh LANs are getting speedier as bandwidths get broader



Two possible configurations for Macintosh LANs. The topology shown below is the basic AppleShare setup. The star configuration shown above permits many more Macs to be connected through a central hub.



When Apple introduced the LaserWriter in 1985, its AppleTalk wiring system (now LocalTalk) was the only game in town for connecting Macintoshes together in a LAN. Since the predominant reason for installing an AppleTalk network was to share a LaserWriter, speed was not such an issue. There were no real network applications available.

However, with some 700,000 Macintoshes now joined in LANs of three or more machines (38 percent of all installed Macs, excluding those used in the home) potentially running file server and network applications, speed is of the essence. More users are now taking advantage of products that make possible data-transmission speeds of 1 to 10 Mbps.

Users of IBM PCs and compatibles have always had a number of LAN options. Many of the approaches common in the IBM PC and compatibles world, such as Ethernet, token-ring, token-bus (Arcnet) and broadband (IBM PC Network) configurations, are becoming available to Macintosh users.

Although its 230-Kbps bandwidth makes it slow for all but very small LANs, AppleTalk is easy to install and use, and its LocalTalk wiring system can be easily adapted for use with the existing modular wiring found in most business offices. In addition, AppleTalk forms the basis for any Macintosh network to build bridges, or gateways, to other networks.

Farallon Computing Inc. of Berkeley, Calif., has developed an alternative that allows Macs to be networked using existing phone wire (unshielded twisted-pair cable). Its PhoneNET products are popular enough to be considered a de facto LocalTalk standard.

Farallon's solution includes wiring kits, diagnostic and administrative software (TrafficWatch and CheckNet), as well as repeaters (PhoneNET Relay), and their multinetwork repeater, or active hub, the Star Controller.

On the heels of PhoneNET's success, other vendors have jumped into the market for unshielded twisted-pair LocalTalk cable. Although no other developer offers the complete range of products that Farallon does, each claims that its products offer advantages over the PhoneNET system.

Products include TurboNET and TurboNET ST from Nuvotech of Sausalito, Calif.; CompuNet from Trimar USA Inc. of New York; ModuNet from DataSpec of Chatsworth, Calif.; QuikNet from Belkin Components of Gardena, Calif.; QuickNet, DualNet and TriNet from Infotek of East Patchogue, N.Y.; and TOPS Teleconnector from the TOPS division of Sun Microsystems, based in Alameda, Calif.

Although most of these products closely resemble the original PhoneNET connectors and are distinguished by their lower prices, TurboNet ST has achieved some measure of popularity.

Chris Good, general manager of EZ Interface, a network design and installation company in Seattle, prefers TurboNET ST because "it provides automatic termination and LED status indicators that take some of the guesswork out of network installation and troubleshooting; it is in good supply; and we have had better customer response with the TurboNet connectors," he said.

With close to 5,000 Macintoshes, Dartmouth College in Hanover,

see Page 8

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from Page 6 N.H., may have the largest AppleTalk network in the world. Said one source there, "TurboNet connectors seem to take away some of the 'black magic' that is occasionally required to get a LocalTalk network working properly." In the college environment, "where students are always moving computers around," the source continued, "we needed a more forgiving technology that wouldn't require constant troubleshooting."

One simple way to overcome the slow speed of LocalTalk is with connector boxes. DaynaTALK from Dayna Communications of Salt Lake City boosts transmission rates to 840 Kbps, according to the manufacturer. TOPS claims that its FlashBox triples LocalTalk speed to 770 Kbps. Both are priced at $189 per node and represent a significant savings over Ethernet-based products, but as of press time are not yet available.

Talking through the ether. The EtherLink/NB NuBus card, a 10-Mbps Ethernet card developed by 3Com of Santa Clara, Calif., which Apple sells as EtherTalk, became the first high-speed alternative to LocalTalk. As Ethernet LANs represent the largest installed base in the industry, EtherTalk quickly opened the door for higher-speed Mac-to-Mac connectivity. LocalTalk was no longer an impediment to the development of LAN-based applications that require large amounts of data to be moved around the network.

Kinetics Inc. of Walnut Creek, Calif., was the first to offer Ethernet connectivity bridges for the Mac with its FastPath LocalTalk-to-Ethernet gateway. But with communications to individual Macs still running at LocalTalk speeds, the net speed increase was not dramatic. Kinetics' EtherPort cards for the Mac II and SE and its EtherSC SCSI/Ethernet interface for all Macs offer higher-speed connectivity to an Ethernet network via a 32-bit NuBus card, a 16-bit card for the SE, or through the high-speed SCSI port on all Macs. Depending on your physical connection requirements, models are available for thick- or thin-wire or twisted-pair interfaces.

One of Kinetics' goals is to "beat the 254-node limit on AppleTalk," said Tom Cromelin, director of product marketing. Kinetics is working on a solution that it hopes to provide in the near future. Once Provo, Utah-based Novell Inc.'s NetWare for the Mac is released, probably in the second quarter of 1989, there will be greater opportunities for Mac-to-Mac connectivity, according to Cromelin. With about 2 million MS-DOS NetWare users, Cromelin projects that the addition of Novell to the Macintosh networking arena will further legitimize the Macintosh as a workstation for business. Most large businesses have stopped talking about personal computer networks and are making strategic commitments to distributed information systems. For the Macintosh to be part of that strategy, users will need to rely heavily on vendors like Novell to provide seamless application connectivity, regardless of workstation.

Many of the approaches common in the IBM world are becoming available to Macintosh LAN users.

Dove Computer of Wilmington, N.C., with its FastNet line of Ethernet products for the Macintosh, is another player in the Ethernet market. Dove offers a SCSI Ethernet product, FastNet SCSI, which can be used on any SCSI-equipped Mac. Dove also offers two NuBus cards for the Mac II, the FastNet II and FastNet III.

The FastNet III, one of its more recent introductions, provides a cheaper and more generic Ethernet interface, while the FastNet II provides an on-board 68000 chip for downloading code. It includes features necessary for some added functionality on DECnet (Digital Equipment Corp.'s proprietary network protocol suite). For machines limited to one expansion slot, Dove provides the Marathon LAN 020, an accelerator board with an Ethernet connection.

Arc of the network. Although not as popular as Ethernet or token-ring, Arcnet claims 1 million nodes installed worldwide. Arcnet is a data-link layer product (see OSI article, Page 32) that uses a token-passing *see Page 10*

GROUPWARE

Groping for groupware

By Richard Rawles and Clair Whitmer

If the concept of groupware conjures up visions of sensitivity training and encounter sessions for you, you're probably not alone. Apple employees jokingly refer to products designed for work groups as gropeware. Despite the New Age overtones, connectivity developers are taking groupware seriously enough to begin planning for applications that reside on their networks.

Although no single definition of groupware fits all, most people would agree with Rich Shapero, vice president of Sun Microsystems and general manager of TOPS of Alameda, Calif., that groupware applications are designed to "enable a number of people to work together on a common task."

"Groupware is still a somewhat fuzzy term," said Kenneth Grant, a programmer at Belmont, Calif.-based Oracle Corp. who worked on Object Lens, a groupware prototype developed at the Massachusets Institute of Technology in Cambridge, Mass. But the need for groupware is clear. "The reality is that most jobs are cooperative in nature."

It is probably easier to identify groupware products than it is to define the concept. While some have said they believe E-mail is the simplest form of groupware, it's actually what you do with your E-mail that forms the basis of several groupware applications. MIT's Object Lens addressed the common E-mail complaint that people receive more mail than they can read. Object Lens sorts messages by priority and places them in to-do folders according to who sent the messages. Thus any mail from a vice president, for example, can be placed in a hot folder requiring immediate attention.

Oracle included some of the features of Object Lens into its upcoming Oracle Mail for the Mac. According to Ron Wohl, vice president of Oracle's office automation systems, Oracle Mail allows users to pull out distinct bits of information from Oracle-based reports, querying their messages to weed out junk mail. Such a system supports the theory that "the No. 1 way of managing a business is to manage by exception," Wohl said.

Originally developed for the IBM PC, The Coordinator from Action Technologies of Emeryville, Calif., is an elaborate E-mail system in which people commit to certain actions by responding to prompts during an exchange of messages. The program monitors the status of these "transactions," or agreements, among users. Mac Access, scheduled for release in December, is a window system that will permit Macintosh users to access The Coordinator over a network of personal computers.

Calendaring, or schedule-management software, is another category of groupware applications that automatically schedules meetings, equipment and conference rooms based on information kept in users' electronic calendars. Responding to requests for meetings, the programs scan the calendars for unscheduled time.

MindShare from Plantech of Golden, Colo., is a stackware product based on Menlo Park, Calif.-based Mediagenic's Focal Point that runs on a network and schedules meetings. Like The Coordinator, it keeps track of commitments. Available on a per-site consultation basis, MindShare might be bundled in the future with the Dynamac laptop computer from Dynamac, also of Golden.

Because the success of scheduling software depends on everyone using it, it is frequently criticized. "It's a cultural issue," said Britt Blaser, Dynamac's director. "It has to be decided whether to record [personal calendar information] into a network."

"There are lots of things you don't want on that office computer," said Donald Norman, a cognitive psychologist with the University of California, San Diego, speaking at a recent conference on computer-supported cooperative work in Portland, Ore. For example, "You know from 3 p.m. to 5 p.m. you're going to your son's soccer game or you're going shopping or you're having an affair with the boss's wife."

Perfect Timing, a network-based calendar and scheduling program *see Page 10*

MICHAEL GRECCO/PICTURE GROUP

Shep Tamler, president of Imagine Software, believes Perfect Timing, a network-based calendar and scheduling program, will be the first Macintosh groupware product.

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from Page 10 access method in a bus-oriented topology. By providing a 2.5-Mbps bandwidth, Arcnet offers significant improvement over the slower LocalTalktransmission rates. Actinet Systems of Palo Alto, Calif., offers a 16-bit interface board for the Macintosh SE and a 32-bit NuBus interface board for the Mac II and ties much of its success to the popularity of established PC networking vendors like Banyan and Novell.

Keith Eric of Actinet said, "The strict Macintosh connectivity market is not where we hope to achieve our greatest penetration, but rather once Novell's product legitimizes Mac-to-PC connectivity to the many Novell users in the business market, we see a potential burgeoning demand for heterogeneous corporate microcomputer networks."

Broadband nets. Most of the popular PC LANs on the market offer baseband data transmissions, meaning that only one large frequency band is used to transmit data over the LAN media. Broadband networks, on the other hand, transmit multiple data types on the same media concurrently using multiple frequencies. Because they provide the ideal "transport media" for simultaneous transmission of data, video, voice and more, broadband networks are popular as campus and factory backbone networks.

Cactus Computer Inc. of Carrollton, Texas, is the only vendor that offers a broadband interface for the Mac. The company's broadband products, like the BroadTalk Adapter Board for the Mac II, work by encapsulating Ethernet packets and then transmitting them over a broadband network using the same frequency assignments as IBM's PC Network. IBM's components — cable segments and hubs — can be used to create the cabling plant for a BroadTalk network. The published transmission bandwidth of 2 Mbps allows integration with other network hosts and clients.

Brown University in Providence, R.I., where a large campuswide broadband network has been in place for a number of years, has been using BroadTalk products since May. Steve Carmody, Brown's manager of system development, describes the network as consisting of "eight miles of broadband cable through 100 departments and 40 dormitories, connecting 3,000 Macintoshes." Carmody indicated that Ethernet will eventually become more prevalent on campus, but until then, "BroadTalk provides universal access to a number of campuswide services, including file sharing, host-computer access, electronic mail, campus directories and electronic conferencing."

Because of its modularity, the BroadTalk product is well-suited to Brown's long-term plans. When Brown converts to Ethernet, BroadTalk's modular broadband RF modem can be replaced with Ethernet transceivers without having to replace entire cards.

Cactus has announced both BroadTalk-to-LocalTalk and BroadTalk-to-Ethernet gateways, which offer the same modularity as the Mac II interface cards. These bridges provide a range of options, including thick and thin-wire Ethernet, Starlan and, soon, twisted-pair Ethernet. Both are switch-selectable to provide different bridging paths, depending on the configuration.

Although some of these products have been available for almost two years, the Mac-to-Mac connectivity market is still in its early stages. As the Macintosh becomes more widely accepted in the corporate arena, many more connectivity products will appear. Mac users still have only a fraction of the options that are available for the IBM PC family. The growth and maturation of a number of LAN and work-group applications will certainly drive the need for greater and higher-bandwidth connectivity options for Mac users. ●

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from Page 10 coming from Imagine Software of Fairfax, Calif., purports to circumvent this problem by password-protecting people's calendars. This means that individuals only need to block in times they are unavailable for meetings. Their actual plans remain confidential.

Programs that permit multiple users to access and work on a document constitute a third area of groupware. According to Reese Jones of Farallon Computing of Berkeley, Calif., such products fall under two categories: delayed time and real time.

MarkUp from Mainstay of Agoura Hills, Calif., is a delayed-time product that allows users to highlight, annotate and add Post-It-like notes, as well as to edit a document for review by others. Farallon is expected to announce a competitive delayed-time product.

Farallon offers Timbuktu, a desk accessory that allows users on a network to share a screen and thereby work concurrently on the same document in real time. In addition, some companies are using Timbuktu as a conferencing system to reduce the number of face-to-face meetings.

Rather than act as a substitution for face-to-face meetings, groupware applications may eventually support them. Cricket Software of Malvern, Pa., plans to introduce Cricket Presents Office, a multi-user version of Cricket Presents... that will allow members of a design team creating a presentation to access each other's work.

For instance, a production artist will be able to access the project manager's outline via the Cricket Central software running on a server. Cricket will offer Cricket Presents Office to value-added resellers and systems integrators.

Such systems fall short of "interactive presentations" for group meetings. "Computers are too slow to work in group situations," said Paul Saffo, a research fellow at the Institute for the Future in Menlo Park, Calif. "The threshold of indignation in a group is much lower than that of individuals working alone."

Network vendors clearly see the potential of groupware as a means of selling their products. The Coordinator's underlying mail manager, Message Handling Service, for instance, is part of Novell's NetWare, scheduled for release next year on the Macintosh. With its recent acquisition of Symantec's InBox E-mail program, TOPS has paved the way for third-party developers to write groupware products that run on TOPS.

Nat Goldhaber, one of the developers of TOPS and now a partner in the Cole-Gilbourne venture capital firm that has invested in Imagine Software, said that groupware was implicit in his business plan as early as December 1983. "TOPS needed to be created as a beautiful, simple-to-use platform on which [groupware] could be built."

The trend is toward integrated office systems that run over multivendor environments. Information Research Corp. of Charlottesville, Va., is planning a Mac version of its Syzygy groupware product, which provides E-mail, a calendar and report-generator for managers. The package is intended to run on Novell, 3Com, Banyan and other networks of personal computers.

Discussions of groupware center on issues of authority and language. While TOPS' Shapero said he sees "computers as middle managers" that monitor work activity, others like Norman said they believe that groupware should support a language of negotiation. Many have accused The Coordinator's interface of being "fascistic," a trait that Action Technologies hopes to remedy in a new release. The new version replaces the "est"-like language used to nail down people's commitments with a simpler interface that can be tailored to an individual work group.

Whether groupware is a means for collaboration or a means for management to exercise authority, the overriding problem facing developers is one of sheer complexity.

"There's a big paradigm shift when going from individuals to groups," U.C. San Diego's Norman said. "Individuals are complex. But groups are more complex ... they consist of these complex individuals interacting among themselves, with the environment, with their culture and with society." ●

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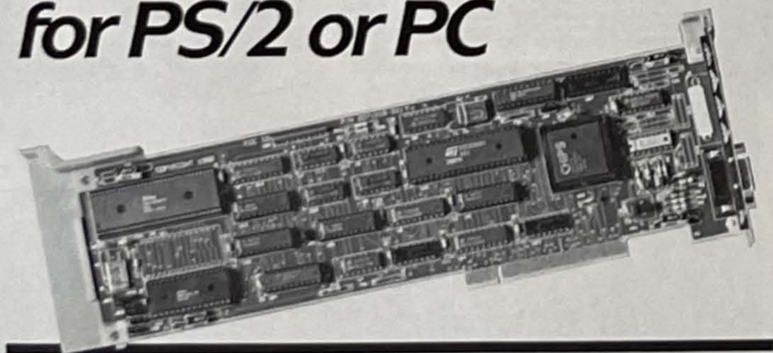

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Multi-System Tape
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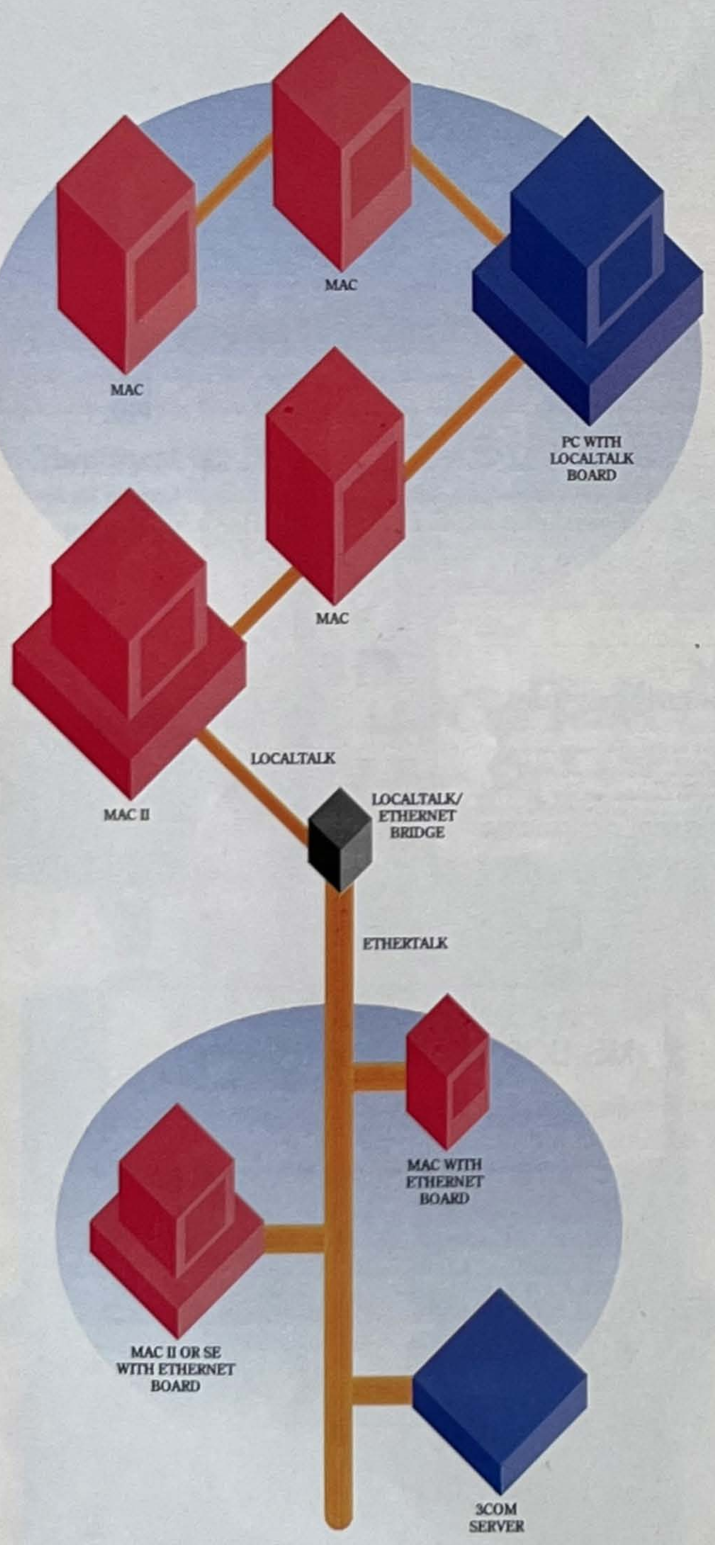
Foreign correspondence: PCs over the LAN

With networked PC users clamoring for Macintoshes, vendors are responding with solutions that make file transfer as easy as … 1-2-3.

By Steve Michel



Given that the IBM PC and its clones are ubiquitous in business and that the Macintosh is gaining in popularity, it's only natural that the network connection between them is important to a growing number of users.

A great deal of data is stored on PC disks: Lotus 1-2-3 files; text files in WordStar, WordPerfect and a host of other formats; databases created with dBASE III and rBase. If a company is simply switching to Macintoshes from PCs, then serial connections are sufficient to transfer files.

Serial connections, such as MacLink Plus from DataViz Inc. of Norwalk, Conn., or LapLink Mac from Traveling Software of Bothell, Wash., require that users on both machines run special programs. Because serial connections are not useful for sharing data and companies want to keep their investments in PCs, managers are more likely to find themselves having to integrate Macintoshes into an existing network.

Networks are meant to offer users access to files, regardless of what machine they were created on or where data is stored, in as simple and transparent a manner as possible. At least that's the ideal a number of vendors attempt to live up to. Depending on your needs, they succeed to various degrees.

The network solution. Available since 1986, TOPS from TOPS of Alameda, Calif., a division of Sun Microsystems, has been a pioneer in Macintosh-to-PC connectivity. Adopting a distributed file-server approach, TOPS allows any station on the network, PC or Mac, to act as a server as well as a client or workstation. Because TOPS does not require a dedicated server, the overhead for smaller networks is not as great. Also, since such network functions as disk sharing are controlled individually, TOPS does not require a network administrator to back up the file server, set passwords and the like.

Not only is TOPS a network solution for mixed Mac and PC environments, it is a leader in Macintosh-only networks. TOPS' support of Sun workstations also makes it an ideal solution for multivendor environments.

Two possible LAN configurations that include PCs are shown at left: either a PC equipped with a LocalTalk board (top) or a Mac equipped with an Ethernet board (bottom). The two LANs can be connected with an Ethernet bridge such as Kinetics' FastPath.

Long a leader in PC networking, 3Com's approach consists instead of dedicated file servers that can serve both Macintosh and PC workstations. Santa Clara, Calif.-based 3Com provides both the software that connects its 3Servers with Macs and software that connects Macs to its servers. 3Com is also shipping 3+Open LAN Manager for the OS/2 operating system. As OS/2 evolves and becomes a more popular choice in the IBM-compatible world, this consideration could be important when choosing a network.

AppleShare supports networks in a couple of ways. With AppleShare workstation support included in the system software, network managers don't need to install special software for people to use network resources. After you connect to a file server from the Chooser, AppleShare works like any Mac drive. Additionally, support for AppleShare's file- and folder-protection schemes are built into the Finder, eliminating the need for a separate networking utility.

"The nice thing about the AppleShare solution is that it is built into every system," said Michael Masterson, micro systems specialist at Arthur Young Co. in San Jose, Calif. "I don't need to maintain separate versions of boot disks for users on different systems. And I don't need to train users to work with different types of software depending on what server they are connected to."

As part of its Mac-to-PC connectivity solution, Apple makes available AppleShare PC, a program for the PC that, when connected to an AppleTalk network via a special interface board, allows PCs to access files on an AppleShare network server. AppleShare PC offers the best of both PC and Mac environments. For those familiar with the Mac, AppleShare PC's desk accessory offers the same interface as the Access Privileges desk accessory on the Mac or the Get Privileges selection on the Finder's File menu. AppleShare PC also allows die-hard MS-DOS users to write batch files to make network connections automatic on start-up.

For many sites, there are a few problems with the AppleShare solution. First, Apple does not offer the "server" software for use on PCs. While this is natural

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Climb out of the Macintosh networking swamp.

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Since the GatorBox is also a full AppleTalk bridge, it supports software developed to work with the Kinetics FastPath, like TOPS, software from Alisa Systems and Pacer Software, and public domain file sharing and terminal emulation applications.

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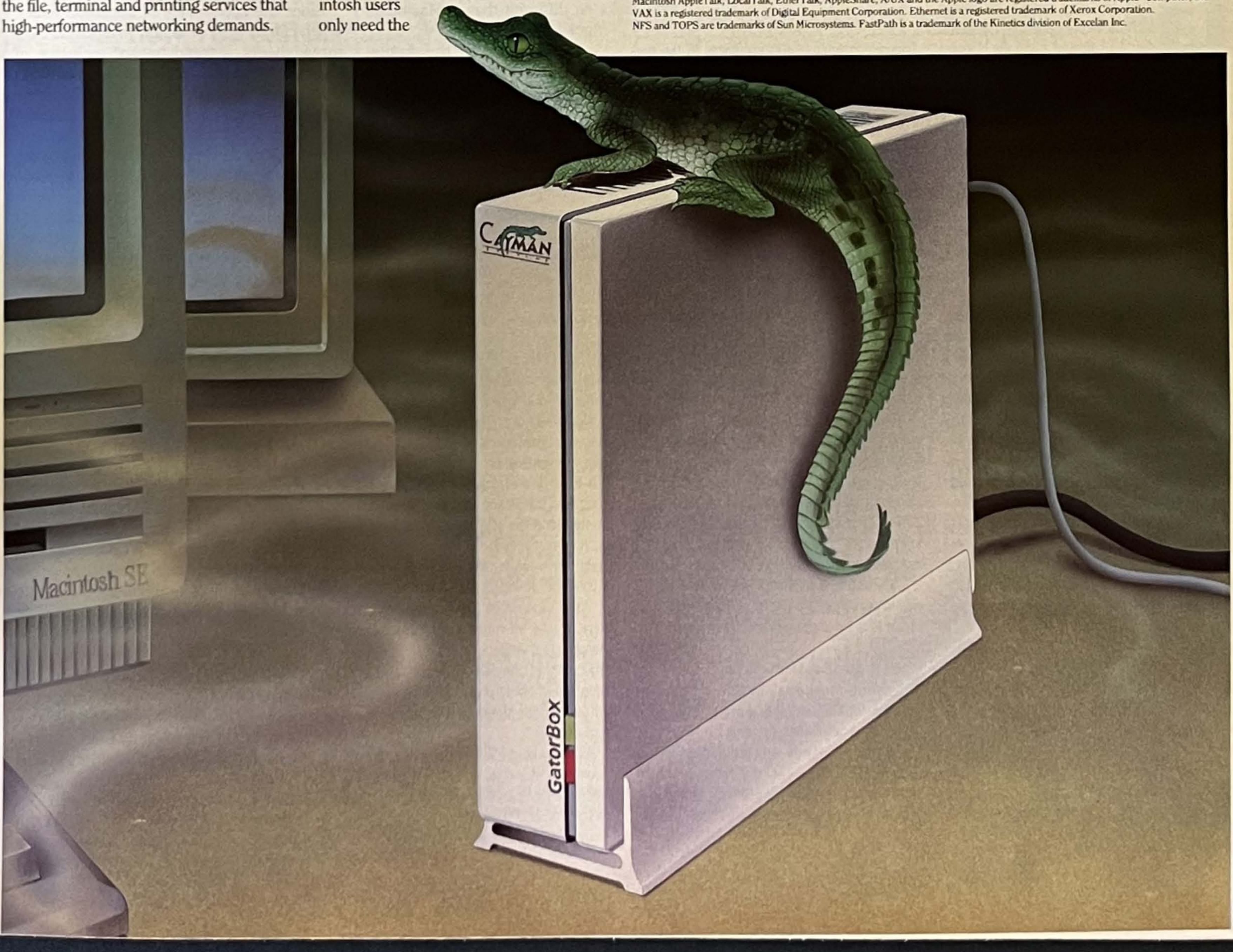

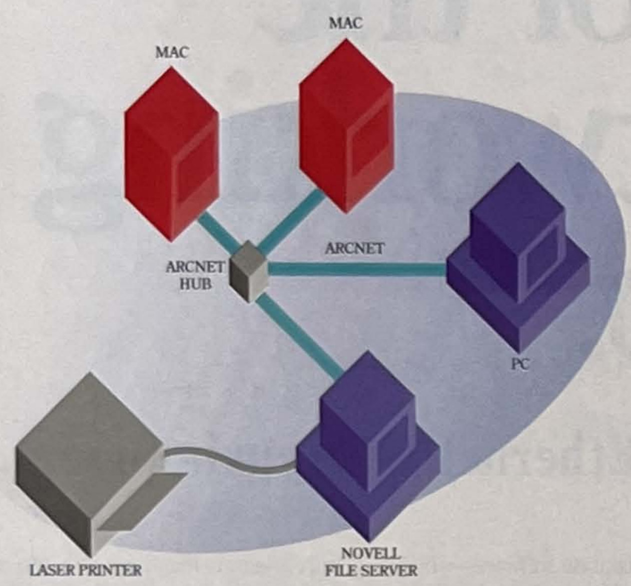

PCs can also be connected with Macintoshes via an Arcnet hub using a token-passing access method (see Page 8).

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since Apple has no interest in promoting MS-DOS machines as network servers, relegating a Macintosh to file server is more expensive than assigning a PC clone to that role. The second problem is that there already exists a large installed base of networked PCs, and Apple offers no means for connecting PC LANs to AppleTalk networks.

The first problem has been addressed by DayStar Digital Inc. of Flowery Branch, Ga., with its FS100 software and interface board. This solution allows an IBM PC or clone to act as network server. PC AT clones with 30-Mbyte hard disks can be purchased for less than $2,500, compared with the more than $3,000 for a comparable SE. And many sites already have a number of PCs that can easily be converted to file-server duty.

Enter NetWare. Novell Inc. of Provo, Utah, offers a solution similar to DayStar's, and in addition the company solves the second AppleShare problem. Novell sells file-server software for PCs as well as the hardware to connect the computers. NetWare for Macintosh consists of software on the PC network server. The PC software translates NetWare's networking protocols for directory (folder) and file protection, as well as file and record locking, into the standard AppleTalk Filing Protocol. To a Macintosh user, and to Macintosh software, the Novell server looks no different than a Macintosh AppleShare server.

Novell's use of the AppleShare standard is important for another reason. With approximately 2 million PCs connected to Novell servers, NetWare represents the largest installed base of any networking software for PCs or Macintoshes. With a large number of PC networks looking to add Macintosh support, Novell's NetWare for Macintosh represents a way for those sites to preserve their investment in hardware, training and software.

Software shuffle. With Macintoshes and PCs coexisting on a network, the second half of the problem comes into play: actually sharing files between programs on different platforms. Previously, users of both Macs and PCs often had to resort to the lowest-common denominator, ASCII text files, to transfer information. Unfortunately, not all data stored on PCs is easily reduced to ASCII files, which may lose the document formatting in word processors, the formulas that comprise spreadsheets and the interconnections between related files in database programs.

> *In many offices, E-mail is the prime mover behind the network.*

Aided by two developments, the file-transfer situation is changing for the better.

Since the appearance of Microsoft Excel, which can directly read and write Lotus 1-2-3 spreadsheets, a trend toward inclusion of file-translation facilities has emerged. As more programs, from Aldus PageMaker to WordPerfect to Excel itself, have appeared on both machines, files created on one machine can be read by the other. Also, some programs, such as MindWrite Express from Access Technology Inc. of Monterey, Calif., can now read files created by entirely different programs on the other machine. MindWrite Express uses translators, called filters, to allow it to transparently read files created by a number of word processors on both the PC and the Mac.

The second development that makes file transfer easier is the prevalence of separate translation programs. Driven mostly by MacLink Plus producer DataViz, translator programs are becoming more common. Apple includes with its system software Apple File Exchange, an extendible tool for translating files, and DataViz has adapted its translators to work with this program. While using file-translator programs is certainly not as simple as directly reading PC files into a Macintosh program or vice versa, these translators make the networker's job much easier.

Another solution, present in 3Com's network and to a lesser degree in AppleShare, allows network users to "map" PC files to Macintosh applications. For example, normally, to open a 1-2-3 spreadsheet on the Mac, you must first open Excel and use its Open command. By using

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ADVANCED MESSAGING

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Messaging gets smart

By Michael Miley

E-mail as it has come to be known on the Mac is about to undergo some profound changes. Expect your electronic mailman to be more intelligent, to have wider reach, and to have more say on how business conducts itself and how data is translated. Intelligently routed "smart" messages, X.400 gateways to wide-area networks and Electronic Data Interchange (EDI) will be part of the LANscape of the future.

Smart Messages. "The notion of smart forms, or intelligent routing, basically means that a message carries some instructions along with it," said Jim White, former director of messaging architecture at Telenet Communications Corp. of Reston, Va., and co-founder with Rich Miller of Rapport, a messaging consultancy company also in Reston. "For example, such a message might be a travel expense report that contains a routing list of the people who are to receive it: first, to the manager for initial approval, then to the director of the department, and then on to accounting and so on."

The forwarding idea could be extended to include a list of people who receive your messages when you're on vacation. The intelligent form idea could be extended to include intelligence on the receiving as well as the sending end. For example, once a form is received, it could be automatically filed and prioritized without user intervention.

X.400. The movement for interconnection of messaging systems with one another is an important trend in the E-mail market. "A global messaging network is now being put into place," White said. Recent agreements between Novell Inc. of Provo, Utah, and British Telecom to bring X.400 standards to the personal computer industry has emphasized the need for a global messaging market. "The need for such standards is self evident," White said. "Just as you wouldn't want five phones on your desk to communicate over five different phone systems, you don't want a grab bag of proprietary gateways to public and private messaging systems."

The X.400 standard was issued in 1984 by the Consultative Committee for International Telegraph and Telephone. "Its importance is underscored by the fact that X.400 has been embraced by all the major players in the messaging arena," White said. "And regardless of whether a vendor is in compliance or not, everybody has his own story about how he's going to achieve it."

X.400 provides for protocols on three levels. P1 is a standard applications protocol for relaying a message from one system to another; it is called the "electronic envelope." P2 is a standardized format for the electronic memo — a message's to, fro, and date fields. According to White, P2 "defines a kind of lingua franca for computer-based messages." P3 are standards for connecting a user at a workstation to any public messaging system and how the mail server is to be used on that system.

EDI and document interchange. Two other application areas that will be affected by the development of the store-and-forward architectures of E-mail systems are electronic document exchange and document interchange. EDI concerns the inter-company exchange of business documents. For example, General Motors already requires that vendors transact much of their business, including invoices via EDI. The store-and-forward ability of E-mail servers becomes an enabling technology as EDI helps a company transact its business electronically, exchanging forms from computer to computer.

Document interchange, on the other hand, concerns the process of translating documents from one application to another via something akin to an E-mail server. Documents are sent along with translation requests, and those documents may be translated into human- or machine-readable form. For example, invoices could arrive formatted for routing by the user or coded for routing by the network.

"With companies like GM behind it, EDI is likely to take off more swiftly than document interchange," White said. "If GM, say, can cut $300 off the manufacturing cost of every car using EDI, it might issue ultimatums to suppliers that require them to submit their invoices electronically."

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3Com's mapping features, you can double click on an MS-DOS file with a "WKS" extension and open that file in Excel — the same as when you double click on an Excel document. This solution works with programs that support standard MS-DOS extensions, such as spreadsheets and databases, but with word processors, most of which don't have standard extensions, you still must open the file from within the application.

Moving files is only one of the functions networks perform. In many offices electronic mail is the prime mover behind the network. E-mail systems also are converging on the two machines, with packages such as QuickMail from CE Software of West Des Moines, Iowa, and Microsoft Mail offered in versions for both machines. TOPS has recently purchased InBox, the first Mac-to-PC E-mail program, from Symantec of Bedford, Mass., and will provide it free with upgrades to TOPS users.

The hardware connection. Of course, before you can install the software necessary to allow Macs and PCs to share files on a network, you must make a physical connection between the machines. There are several ways to do this. All Macintoshes, of course, include the necessary chips that allow them to work with LocalTalk connectors, so connecting them to a network is simply a matter of buying the connectors and hooking them up.

PCs, on the other hand, do not include any built-in network hardware support: You must add an interface board to the PC to connect it to the network. If you are using a LocalTalk network, several solutions are available. For TOPS networks, TOPS' FlashBox allows LocalTalk networks to communicate at three times the 230-Kbps standard network speed.

Apple's LocalTalk PC board, priced at $249.50, is another solution, as are the interface boards formerly produced by Tangent Technologies of Norcross, Ga., and now available from DayStar Digital. At the time of this writing, DayStar is the only company that makes a LocalTalk interface board for the newer Micro Channel Interface present in many models of IBM's PS/2 line of computers.

> *Networks should offer users access to files regardless of where they were created.*

If you are planning to use Novell's NetWare for Macintosh, you will not need to add LocalTalk interface boards to your PCs. Instead, you will use interface boards provided by Novell and other companies that support Novell NetWare. If you already have a NetWare installation, you have the boards you need.

The clear trend in Macintosh-to-PC networking is that it is getting easier. Solutions from Apple, TOPS and manufacturers of PC-based networks are providing the means to integrate Macs into those networks. On the software side, increased file compatibility and flexible translation utilities are making it easier for one machine to use files created on the other. Despite the somewhat confusing myriad of products available, after a little research, you will probably find a connectivity solution to match your situation. By building a software library around a combination of features that include the ability to read and write foreign file formats, you'll find that the day-to-day problems of file translation, too, should diminish. ●

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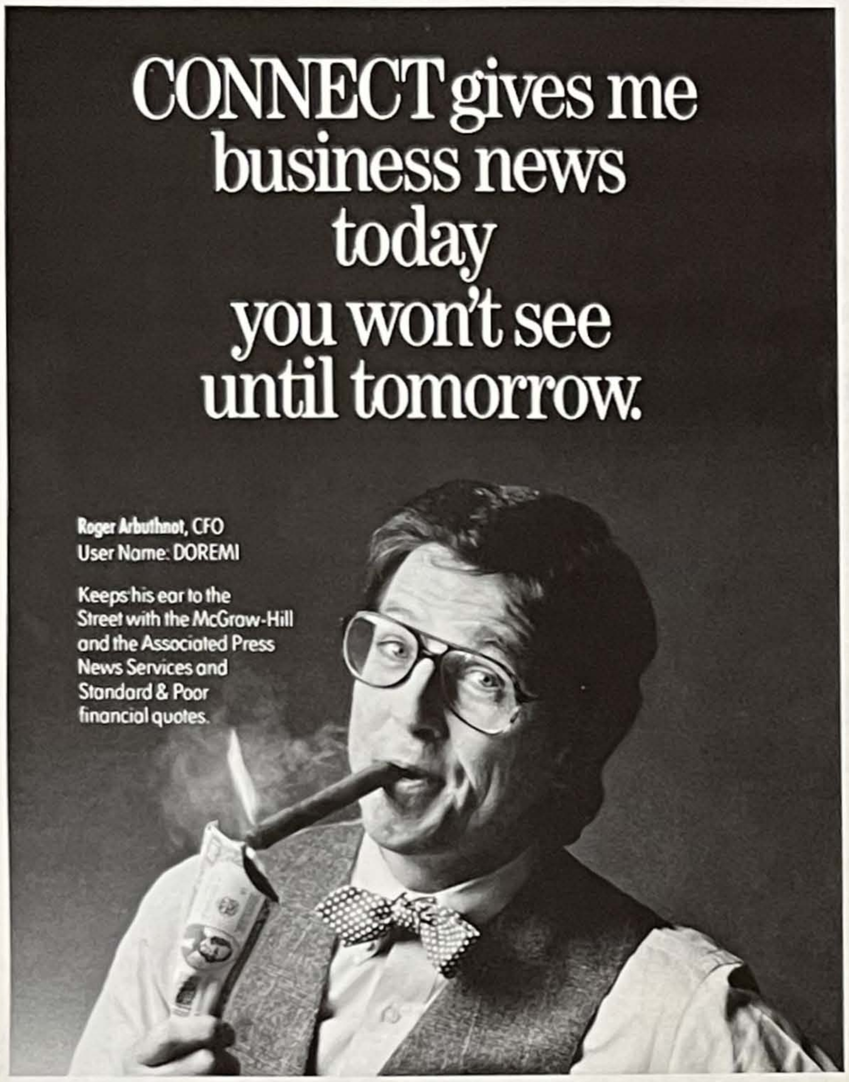

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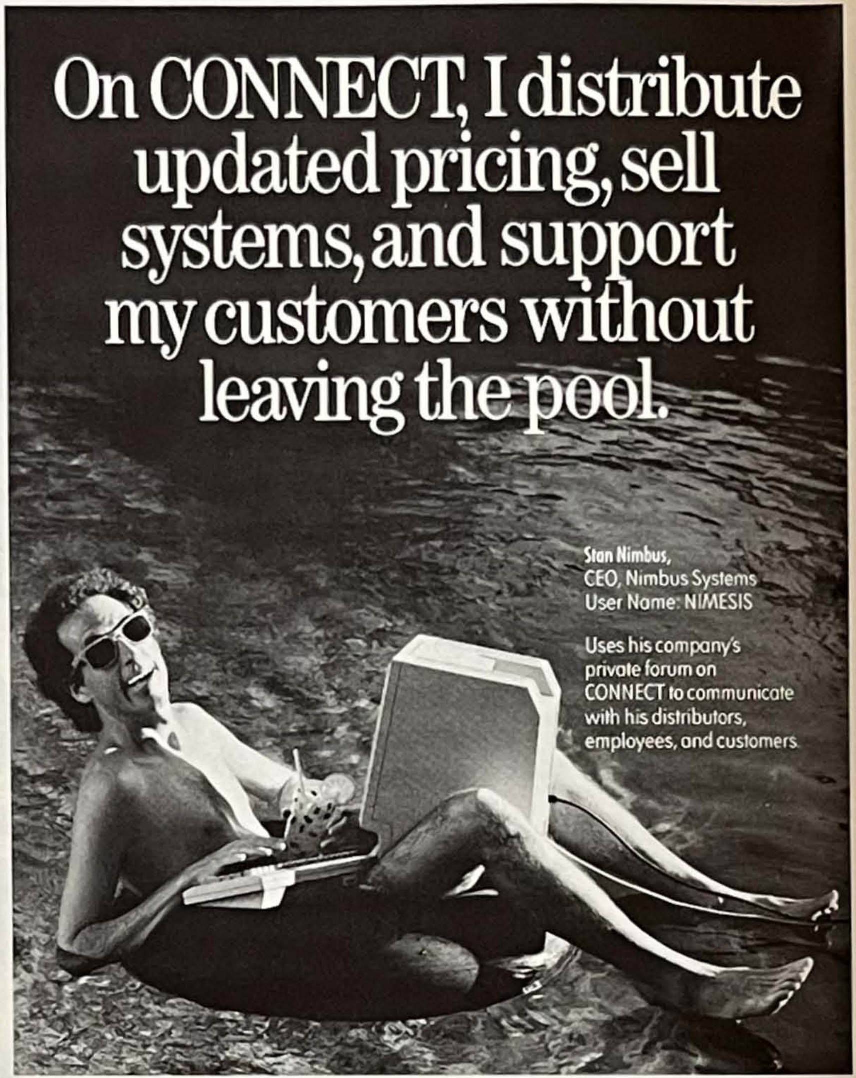

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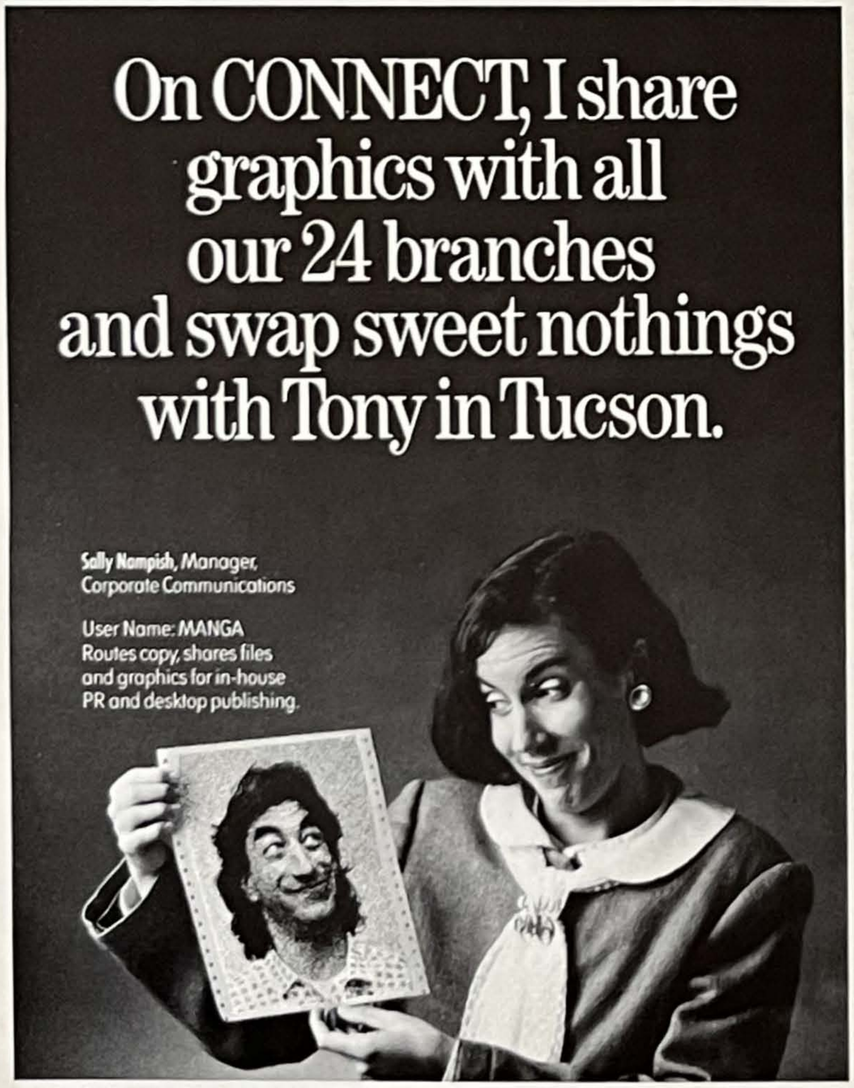

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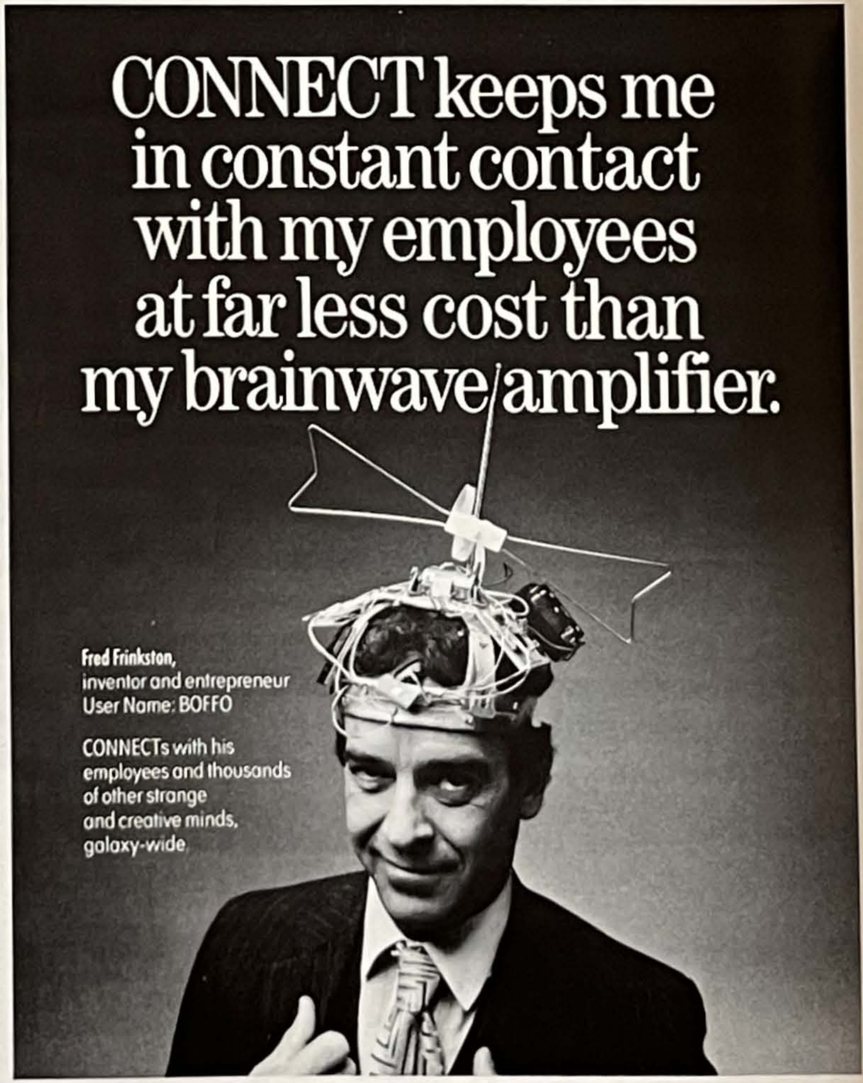

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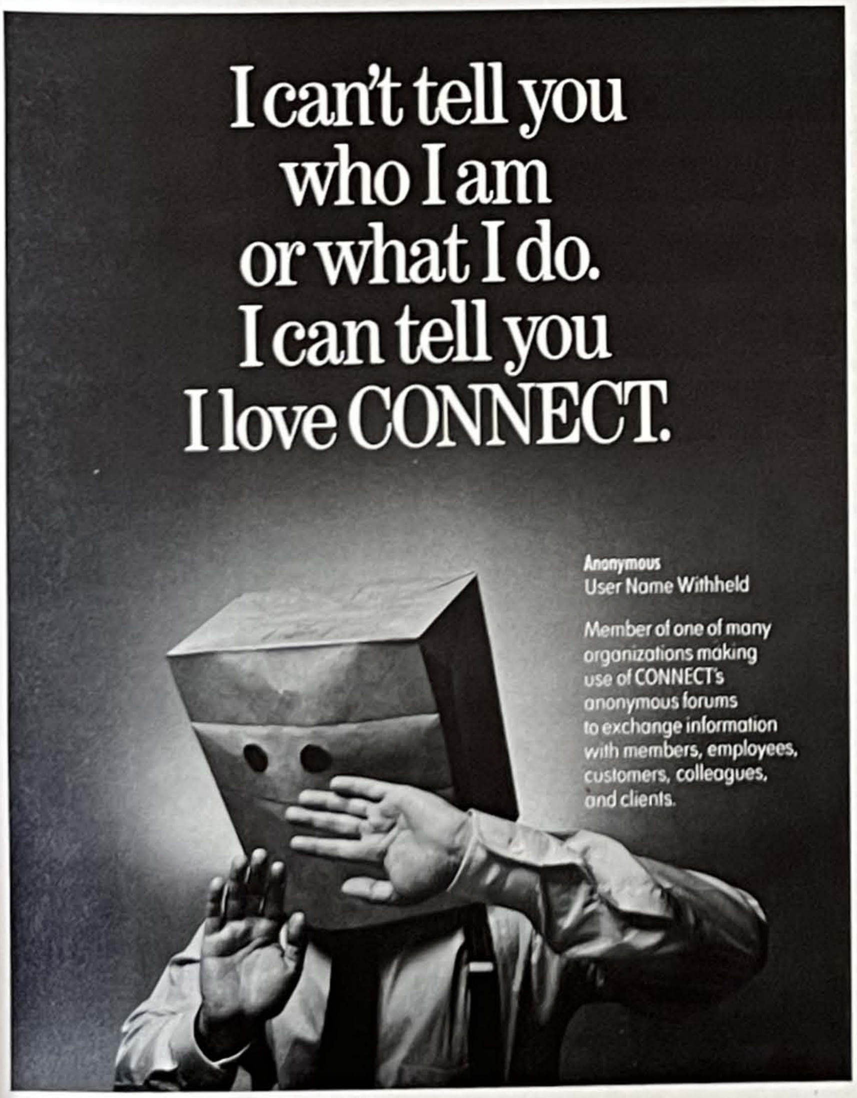

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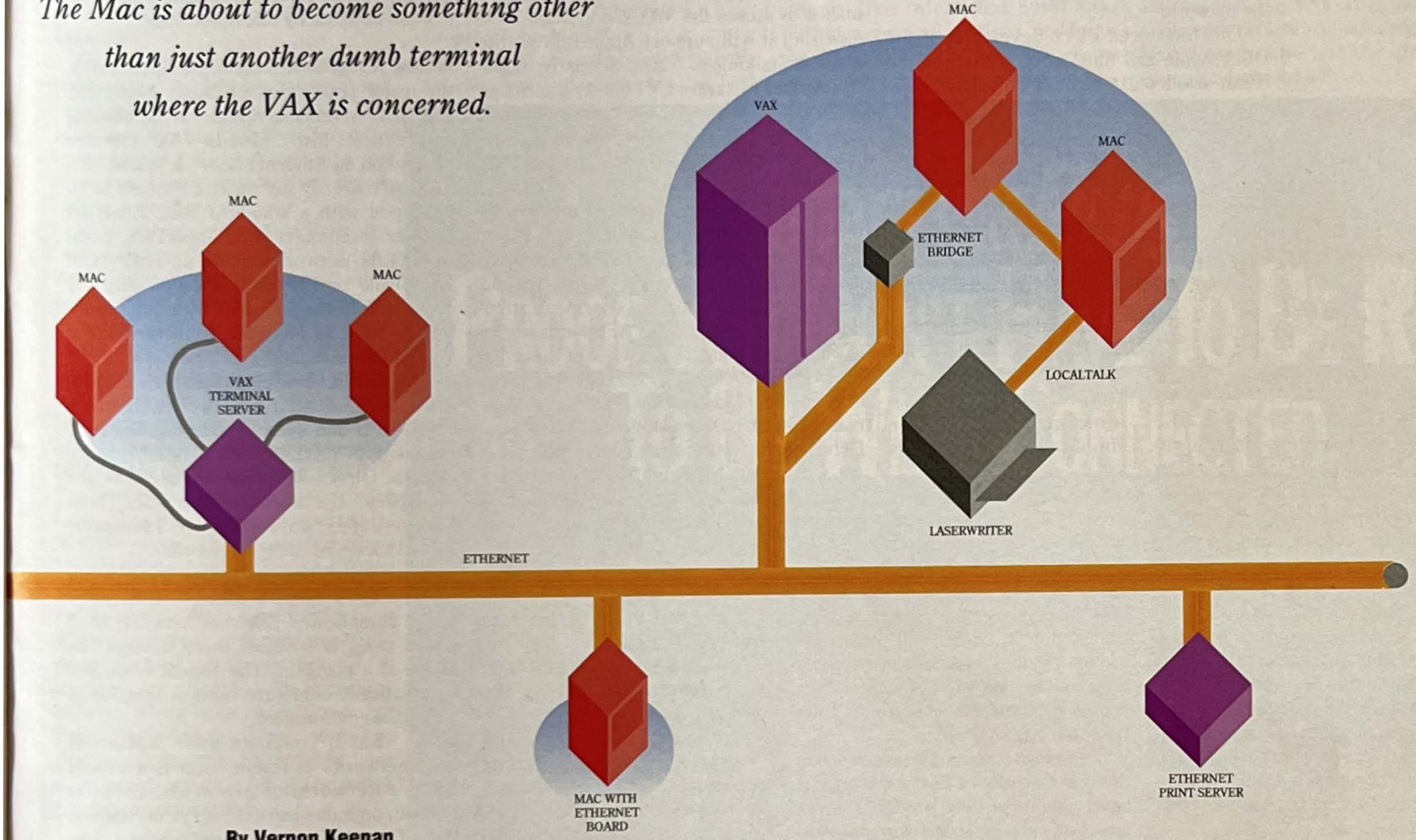


The diagram above displays three ways to connect Macs to a VAX; with an Ethernet board (bottom), terminal server (left) or an Ethernet bridge (right). Each machine can access both types of printers.

By Vernon Keenan

One of the fundamental axioms of the computer industry is "give the customers what they want." The alliance launched last January between Apple and Digital Equipment Corp. to co-develop products and support third-party developers owes its life to that creed. The Apple/DEC relationship came about as a response to the demands of VAX and Macintosh users who wanted to bridge the two systems. In the months since the relationship was made public, the two companies have promised to provide a consistent platform for the integration of DECnet and AppleTalk networks, as well as a new generation of cooperative applications.

The first step in this ambitious long-term plan — terminal emulation, or the ability of Macintoshes to function as VAX terminals — has already taken place and remains an important priority. The VAX's asynchronous communications protocol makes it relatively simple to connect a Macintosh as a DEC VT100 terminal emulator. Apple has also upgraded the Mac's communications capabilities with the new Communications Toolbox, due to be released in a future version of the System software. With it will come standards for supporting multiple serial connections, virtual connections over a network, terminal emulation, presentation systems and file transfers. Terminal-emulation programs will be able to take advantage of these enhancements once they become available.

Beyond emulation. Apple and DEC have also committed to developing software that will allow managers to view AppleTalk and DECnet networks as a single network, providing tools to analyze and debug problems on the network. Tools such as Inter•Poll, Apple's network-management utility, should allow these system managers to configure their DECnet networks with a Macintosh.

Print and file services are basic to any VAX and Mac network. File services include the ability to use the VAX as an AppleShare file server. The VAX's print spooler and both machines' ability to access each other's printers are among the network's print-service capabilities. Such services are already available from Pacer Software of La Jolla, Calif., and Alisa Systems of Pasadena, Calif., but DEC and Apple have committed to producing them as integral parts of the VAX's VMS operating system.

DEC and Apple also recognize document exchange as critical for development. To this end they have adopted DEC's Compound Document Architecture (CDA) as a unifying philosophy to guide them toward a common realization of what is needed to exchange and use documents created on a variety of platforms.

These developments lead to a new generation of applications capable of dipping into vast on-line information and service systems. Included are relatively simple on-line mail databases for creating distribution lists, complex links among a Macintosh mail package and a variety of hosts, and extremely powerful HyperCard stacks or custom applications that use the CL/1 connectivity language to browse and link databases on DEC, IBM/MVS and OS/2 operating systems (see sidebar, Page 22).

In a fashion similar to Helix VMX, a database processor from Odesta Corp. of Northbrook, Ill., tools like CL/1 will enable developers to create back-end database servers on the VAX. Mac users will be able to enter and view data from individual databases. Macintosh-based front-end applications will be created with HyperCard and other development platforms

see Page 22

from Page 21

that are connected to CL/1 servers on the VAX. The real power of CL/1 as a "data dipper" will come with its ability to bring together data from a variety of databases and files on a VAX, linking them to databases on other systems connected to the network.

The final area of co-development for DEC, Apple and third-party vendors is the realm of videotext, electronic mail and computer conferencing. Although development in this area is still hazy, it appears that Macintosh users will eventually be able to automatically link into VAX/VMS mail, videotext and conferencing systems. How or when this will happen is still unknown.

Careful examination of the DEC and Apple development announcements, however, reveals that the two computer giants have simply specified various proprietary networking communications protocols that each has developed as a standard. For example, DEC has said that it will support the AppleTalk Filing Protocol (AFP), an Apple-developed standard that is the basis of AppleShare, as a way for Macintoshes to access the VAX file system. DEC also said it will support AppleTalk as the basis for talking to Macs. Similarly, Apple has agreed to support VT100-style terminal emulation and the DECwindows network windowing protocol as well as to support DEC's X.400 mail-network strategy and VTX videotext servers.

This mutual back scratching has several implications for Macintosh users. First, Apple and DEC are presenting their own visions of how network systems should behave and are not paying enormous attention to industry standards. AFP, for example, is somewhat related to NFS, the network file system developed by Sun Microsystems that has been adopted by NeXT as well as many other UNIX-oriented computer manufacturers. But without an appropriate gateway, NFS and AFP are not compatible. Also, neither AppleTalk nor DECnet are standards that cut across many different vendors, unlike such widely available standards as Transmission Control Protocol/Internet Protocol (TCP/IP).

This may not be all bad. DEC has committed to making the VAX understand AppleTalk. Both of the original VAX file servers offered by Pacer and Alisa require the use of custom desk accessories to access the file servers. Now both vendors have adopted the use of Apple's Chooser desk accessory, making their product function exactly like AppleShare.

Getting it together. Despite these concerns, the major practical issue facing Macintosh and DEC systems integrators is the physical connection. Most Mac-to-VAX schemes depend on an Ethernet network system. If a VAX isn't already networked, it needs to be equipped with a standard DEC Ethernet adapter to connect with AppleTalk. Local AppleTalk networks made up entirely of LocalTalk- or PhoneNet-type cabling are connected to the Ethernet with a hardware bridge such as FastPath from Kinetics of Walnut Creek, Calif.

The Kinetics box plugs into both the Ethernet and LocalTalk networks. It has a 68000 CPU and software that handles routing of data packets and other bridging chores. Direct Ethernet connections are available for the Macintosh II and SE. These add-in cards automatically recognize EtherTalk on an Ethernet network.

Using a Kinetics box can be tricky if you are trying to blend a Macintosh network into a complicated Ethernet network. If all you're using is DECnet, there shouldn't be much of a problem. The Kinetics box will automatically configure itself to function in that environment.

But if you want your Macintosh networks to readily access a variety of networking protocols, there is an ominous learning curve to conquer. The difficulties begin when you select and configure the software that goes into the Kinetics box. Integration of products from multiple

REMOTE DATABASES

Navigating data space

By Vernon Keenan

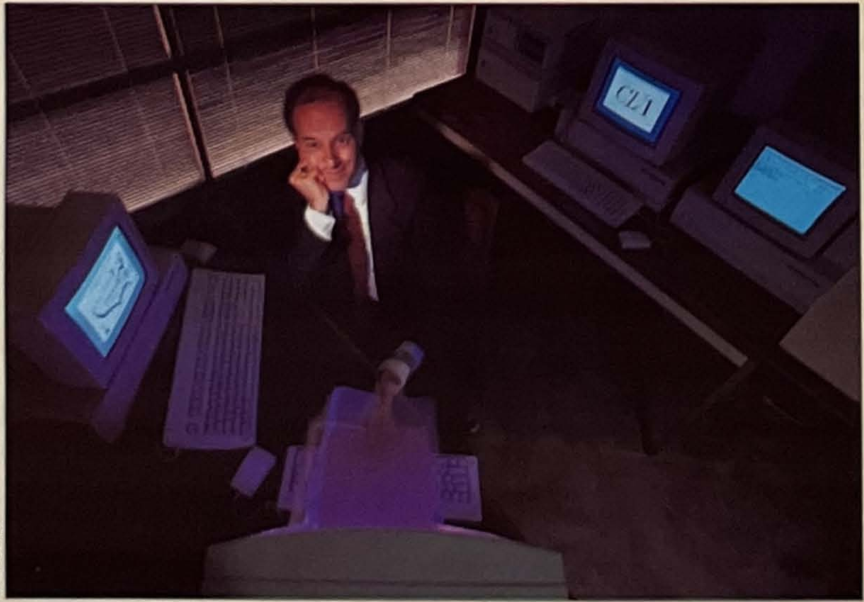
In John Sculley's vision of the Knowledge Navigator, computer users deftly cruise through vast on-line databases to meet their information needs. According to Apple videos promoting the concept, researchers can use this powerful on-line medium to transparently dip into any information system their Mac can access.

How is the brave new world of the Knowledge Navigator going to come about? Getting Macintosh applications to understand different database structures and retrieve data from them is a good first step. To this end, Apple-owned Network Innovations is implementing its Connectivity Language 1 (CL/1) networking language as a means for Mac users to access remote foreign databases.

With Apple's adoption of CL/1 as a model for the way that the Macintosh will relate to a variety of database systems, the Knowledge Navigator fantasy has moved a few steps closer to reality. Recent endorsements from Digital Equipment Corp., Oracle Corp., Relational Technology Inc. and Informix Inc. confirm the viability of CL/1 and underscore its significance to information system managers.

CL/1 will run on the Macintosh as sets of external functions in connection with HyperCard, ACIUS' 4th Dimension and other stand-alone applications. A CL/1 server for VMS provides connections among a Macintosh client and Informix/SQL, Ingres, Oracle, Sybase, VAX Rdb and VAX RMS database and file systems. These databases will be linked to users' Macs through AppleTalk and other protocols like TCP/IP and the SNA family.

"Transparent access and integration to host databases from within a desktop application is becoming a requirement for major software developers and corporate end users alike," said Jim Groff, president of Network Innovations. Groff described his company as a broker of connectivity solutions. "Our objective is to provide users with a plug-and-play ability to access their data. CL/1 will enable developers to offer shrink-wrapped packages that will be able to access a wide variety of database systems," he said.


DRAKE SOREY

Jim Groff, president of Network Innovations, demonstrates CL/1's ability to "pull out" information residing on any computer system's database.

CL/1 enables Macintosh developers to adapt current word processing, database and spreadsheet applications for easy access to services offered by CL/1-based systems. "Developers need to be concerned about what happens on the desktop, not how things will fly over the wire or what happens at the host," Groff said. In the not-too-distant future these applications will be able to reach out and grab data from remote databases with the ease that Macintosh users have come to expect of most Mac applications. Some developers will be spurred on to create new applications that exploit the best features of CL/1, such as multiprocessing and merging of flexible databases.

MacDBC from Access Technology Inc. of Monterey, Calif., is the first new application that has been created especially for CL/1. MacDBC, which stands for Macintosh Database Connection, is a stand-alone application that allows end users to transparently access and extract data from remote VAX databases using CL/1 as a bridge.

"The average end user may not want to spend the time learning about SQL, communications protocols and the 'black boxes' that sit on top of the VAX," said Ray Kingman, director of sales and marketing for Access Technology. "What they want is a painless way to get the information from the host and bring it over to the Macintosh where it can be used as part of a dramatic presentation or a key proposal."

MacDBC works very much like any Mac application. You simply select a database with a double click, pick the relations or data sets you wish to view, and select attributes or variables in the relations. It's easy to formulate a simple database query, watch MacDBC retrieve the data, and save it in Excel or any other basic file format. MacDBC should be available shortly after Network Innovations releases the CL/1 server for VAX/VMS.

Dexpo West 88 last month featured several developers that demonstrated CL/1 applications, including Access Technology's MacDBC, ACIUS' 4th Dimension, Ashton-Tate's Full Impact and Informix Software's WingZ. Two newcomers previewed applications as well. Applications Design Inc. of Los Gatos, Calif., showed an executive information system prototype and SoftCore Creative Technology of Brussels, Belgium, presented an optical-based archival system.

With no formally announced release date for the CL/1 server and toolkit products from Network Innovations, several CL/1 developers don't expect products to become available until after January.

While the ability to access large masses of data on-line is still only a distant possibility in Apple's eye, solutions like CL/1 may provide the Knowledge Navigator with its sextant and compass. ●

vendors other than DEC and Apple remains something of a black art.

Next you need to select what services you will be using to support your new networking scheme. Basic choices include AppleShare, LaserWriter printing, a mail system and terminal emulation.

Only Pacer Software and Alisa Systems support AppleShare and print and terminal services from VAX/VMS. Although the functional differences between the two packages are not great, you should consider them before making a purchase decision.

Alisa Systems offers AlisaShare, the AlisaTalk package that has the AppleTalk for VMS bridge; an AFP-compatible file server; print services, including a bridge to DEC's LPS-40 PostScript printer; and a DECnet bridge that supports terminal emulation. The system is fairly easy to install and works reliably, and the architecture of the Alisa system matches the DEC/Apple plan very closely.

Pacer Software's products differ from Alisa's in several respects. Its AFP file server, PacerShare, functions identically to AppleShare and AlisaShare. PacerLink, the terminal emulator, however, differs significantly from Alisa's system, offering multiple concurrent VAX sessions. Simple file transfers are possible with PacerLink as well. Users have complained that Pacer's printing services are not as flexible as Alisa's but that there have been problems with Alisa's terminal-emulation performance.

It's not over. Even if you've resolved all your AppleTalk addressing and zoning issues, the Kinetics boxes or interface cards are all working and you can now access your VAX as if it were a giant hard disk, you can't give a sigh of relief yet.

Solving all the nuts-and-bolts technical issues is really just the beginning. A VAX system administrator needs to carefully present the system so it gets used properly. It is necessary, for example, to present zones, print queue names and file server names in a consistent and intelligent way when they appear in the Chooser. An even bigger issue is how people will use the system so an administrator can fine-tune the performance parameters and other configuration factors.

Finally, don't forget user education. If this type of integration is to be successful in a large company, the appropriate documentation needs to be developed and distributed. In addition, classes help people understand what different capabilities are available from the network.

Apple and DEC won't be shipping their new connectivity products until well into 1989. What users can do in the meantime is choose either Pacer or Alisa for their basic Mac-to-VAX connection and wait until 1989 or 1990 before converting to the official DEC/Apple software or upgrades to Pacer and Alisa. But by deciding to go with Pacer or Alisa now, you will be spending $5,000 to $10,000 to get your company connected.

By staying abreast of developments, you can identify the products that best meet your future needs. Last month's Dexpo West 88 in Anaheim, Calif., was the scene of new product announcements from Alisa, Network Innovations, Access Technologies, Kinetics, Grafpoint, Ashton-Tate and a few newcomers like Integrated Solutions. Within a year all of their products should be out of the betaware realm and finding their way to market.

The most exciting area of development will be the CL/1-based products. Network Innovations of Cupertino, Calif., is well on its way to being a major player in connecting the Macintosh to a wide variety of computers, and not just the VAX. It is just such multivendor solutions that will give the Mac greater entré into the offices of systems administrators. ●

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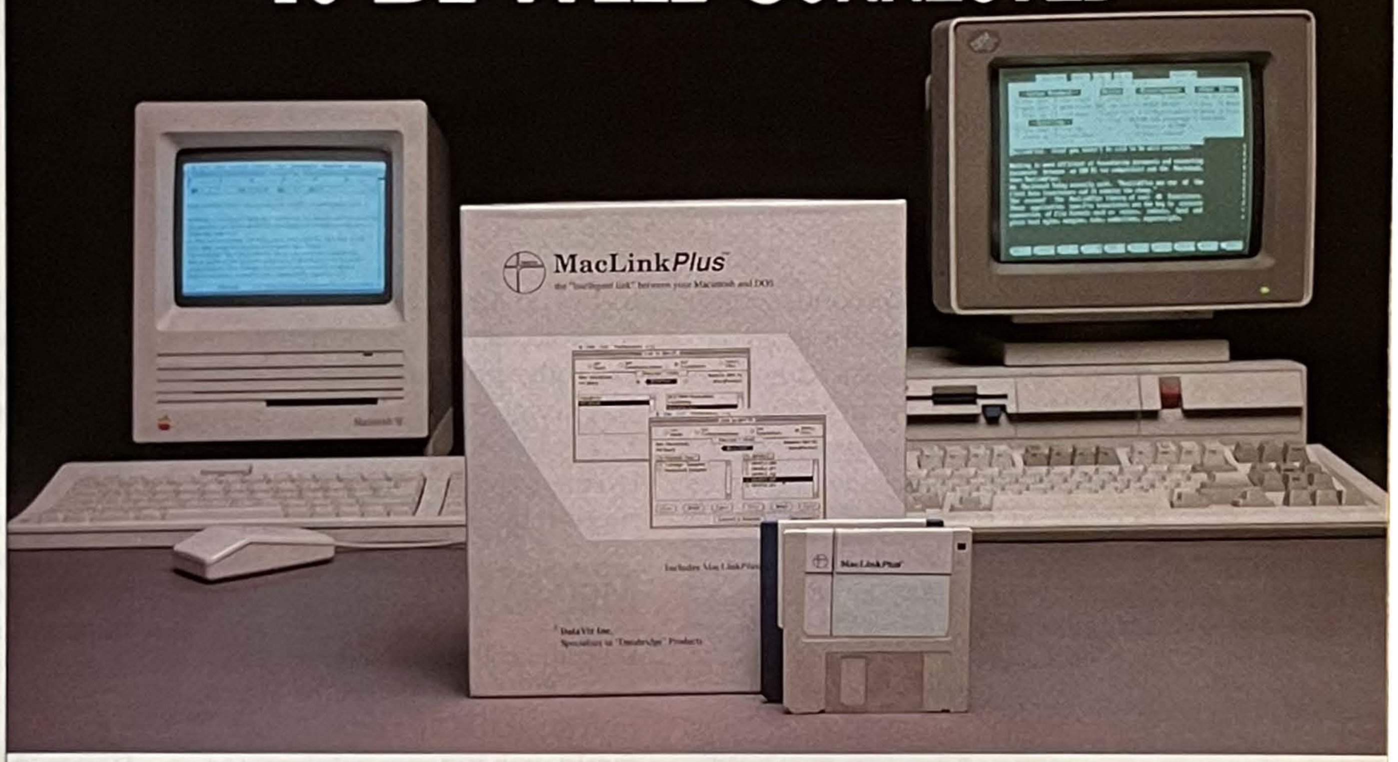

Whatever Macintosh-PC setup you have, MacLink*Plus*—at $195—provides the very best solution for transferring and translating files and documents between the two.

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And if you have Macs and PCs on a network or AppleShare server, etc., the MacLink*Plus* file translation capabilities are worth the price alone.

So, if you want to be really well connected, the size of your wallet really doesn't matter. Just call (203) 268-0030 for your nearest DataViz dealer. Because as Macintosh Today recently said, "MacLink*Plus* was one of the first data translators and it remains the champ."

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System Requirements: Macintosh Plus, SE and II. All IBM PCs and compatible systems.

The Best-connected

Mac to Mac

Kinetics advances the connectivity frontier with Ethernet for the Macintosh. Now you get truly faster AppleTalk so your Macintoshes can communicate as high-speed personal workstations. And because we're compatible with the new EtherTalk standard, you can use your standard AppleTalk software packages including file and disk servers, multi-user database systems, and electronic mail.

Enter the high-end of AppleTalk networking with the Kinetics EtherPort SE. With this internal Ethernet option card for the Macintosh SE, choosing Ethernet for applications networking is as easy as clicking a control panel selection.

For the SCSI-based Macintosh, including the Macintosh Plus, you can have direct access to Ethernet through the SCSI device chain. Just add on the Kinetics EtherSC, our outboard Ethernet controller.

And to mix-and-match Macintoshes on Ethernet with Macintoshes on AppleTalk Personal Network cabling, the Kinetics FastPath AppleTalk-Ethernet gateway connects the two networks. The FastPath acts as a bridge between networks, providing full support for AppleTalk zones.

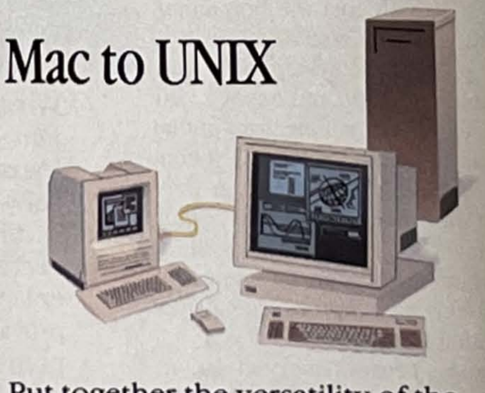
Mac to VAX

Ethernet is the network of choice in the DEC world. And the Macintosh fits naturally into the DEC world with Kinetics products for the Apple-DEC connection. Your Macintosh on an AppleTalk network, or connected directly to Ethernet, now becomes a vital part of the Mac-VAX computing system.

Let the VAX be a file server for the Macintosh. Let the Macintosh be a terminal for the VAX. Share printing resources along both networks. And access the worldwide services of DECnet.

Kinetics products provide the foundation for the best third party packages adding network values and building on AppleTalk, DECnet, and TCP/IP.

Mac to UNIX



Put together the versatility of the Macintosh and the portable, programmable power of UNIX, and you have an ideal network team. Kinetics unites the two with K-Talk, Kinetics' own AppleTalk for UNIX.

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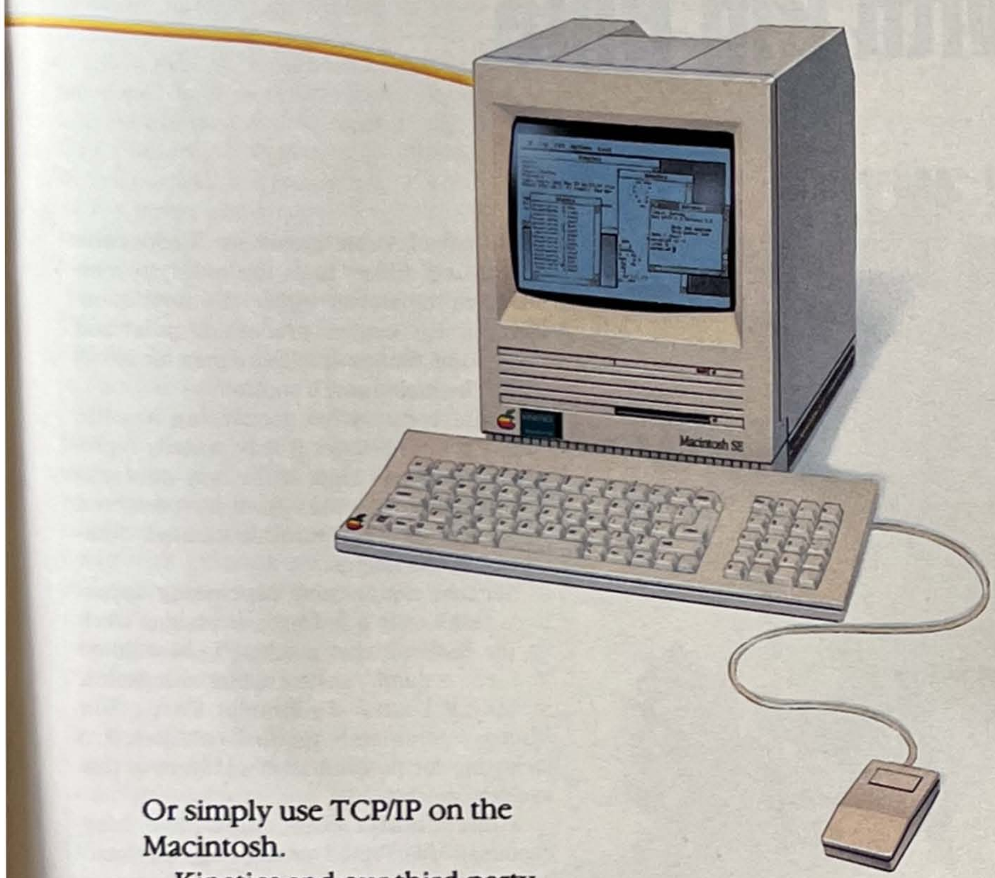
Macintoshes Begin Here. . .



Or simply use TCP/IP on the Macintosh.

Kinetics and our third-party partners offer seamless software built on AppleTalk or TCP/IP to bring the UNIX and Macintosh worlds together. AppleTalk development tools are also available from Kinetics for UNIX programmers who wish to develop custom UNIX-Macintosh solutions. In addition, UNIX system vendors offer special UNIX-Macintosh packages.

Mac to PC

And of course the well-connected Macintosh cannot ignore the IBM PC and compatibles. Whether the PC is on an AppleTalk Personal Network connected through the FastPath to Ethernet, or whether the Macintosh shares Ethernet with a PC, the Kinetics open-system family of products ensures high performance and optimum communications.

Mac to Everything

Kinetics already offers Macintosh networking to more systems than anyone else. And now, as part of Excelan, we're united with the leader in TCP/IP-based heterogeneous networking. Together we offer high-performance, host-to-host communication among the broadest range of systems in the LAN industry — VAXes, PCs, UNIX, micros, minis, Macs and mainframes.

For further information on Kinetics and Excelan products, third-party solutions, or the name of the dealer nearest you, please contact Kinetics or Excelan.

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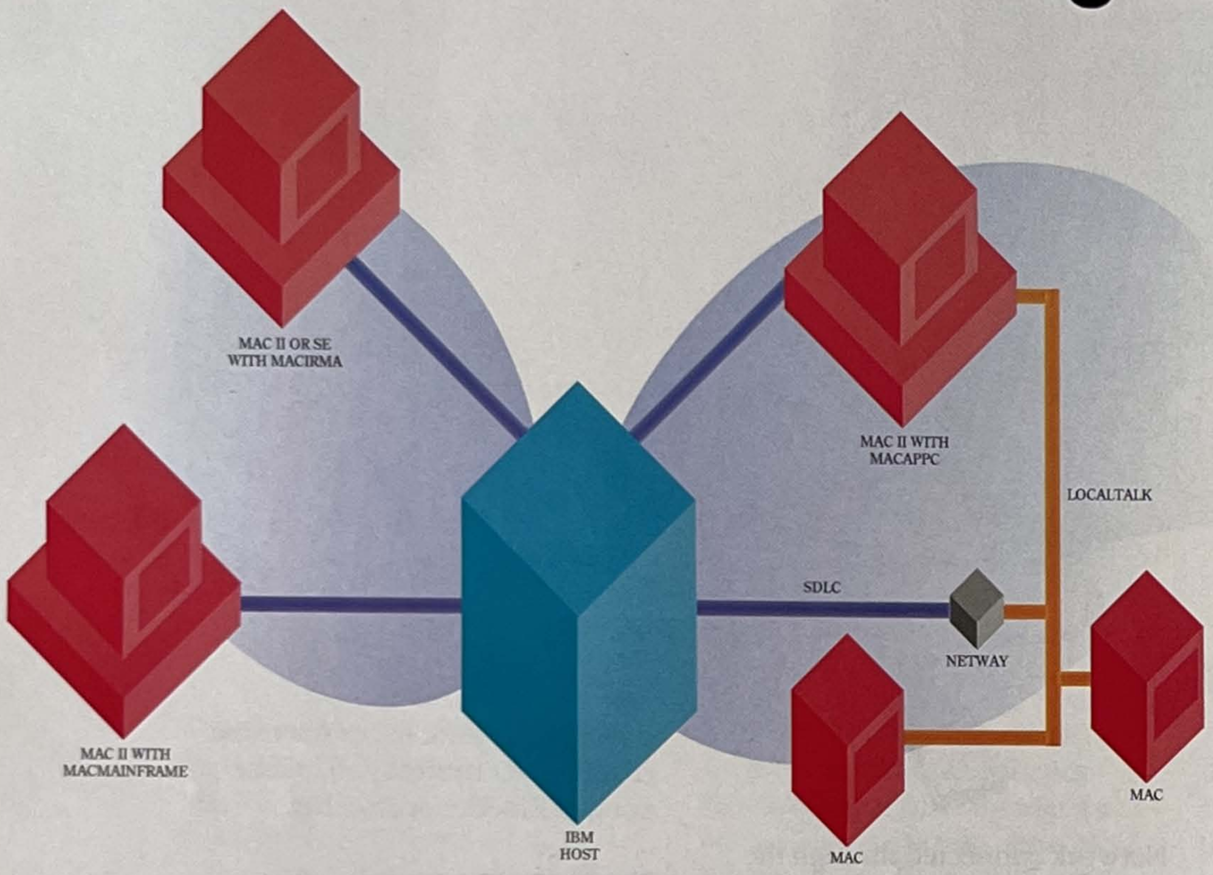
GATEWAYS

MAC TO MAINFRAME

Cooperative processing: Détente with Big Blue

By Peter Lisker



Macs running MacIRMA or MacMainframe can serve as terminal emulators. But with MacAPPC products running on a LocalTalk network, Macs can offload some of the processing from the host via Tri-Data Systems' Netway 1000A.

With the advent of MacAPPC and Mac-compatible SQL database products, IBM mainframes will have to start listening to the Macs on their networks.

When Apple acquired Orion Network Systems, the Berkeley, Calif.-based software company specializing in communications for IBM networks, it challenged IBM's role in connecting microcomputers to mainframes. Ironically, by running versions of Orion software, Macintoshes may do a better job than PCs of connecting LANs to mainframe hosts.

To understand how such a strange state of affairs came about, it helps to examine the concept of cooperative processing, a networking architecture designed to fully exploit the power of the micro in conjunction with mainframe hosts.

"Cooperative processing is all about machines working together to accomplish new and innovative data processing," said Paul Rampel, Orion president. "Cooperative processing differs from the old-style 'master-slave' networks where the host mainframe is the central processing point and micros function as little more than terminals under the mainframe's control."

While cooperative processing has the ring of a buzz phrase, it may actually represent a paradigm shift in the way networks are structured — away from host-centered environments and toward distributed, desktop-oriented systems.

Because cooperative processing apportions tasks over a network, it assigns work on the basis of what machine is best-suited to a job. A number of computer companies, including Digital Equipment Corp., Sun Microsystems and Apollo Computer, are jockeying for position as key players in this evolving market.

Minicomputer companies have long espoused distributed processing, a related concept that divides the processing between minis and their supported terminals, as the logical way to tie together computing resources within networks. With the expanding presence of microcomputers in data processing, however, Apple and IBM share a clear market opportunity, with consequences for the entire DP/MIS field.

In today's computing environments, where microcomputers rival the processing power of mainframes of a decade ago, users and DP/MIS personnel have been stymied in harnessing the full power of the micro. Desktop machines are usually relegated to terminal emulation or to limited file transfers between the desktop and the mainframe. It is precisely this limitation that cooperative processing seeks to transcend.

At the same time, however, IBM's dominance in the Fortune 1,000 market mandates that any cooperative-processing scheme must fit in with IBM's long-term strategic directions.

Setting the standard. SNA (Systems Network Architecture) was developed by IBM in the mid-1970s to unite its disparate telecommunications products under one umbrella. IBM networking required a consistent strategy to succeed. SNA was devised as a base set of communications protocols that could be extended to accommodate new technologies.

The market success of minicomputers

from DEC, Data General, Wang and others in the late '70s presented IBM with a crisis on two fronts. To prevent loss of market share, the minicomputer challenge had to be met head on with IBM's own line of minis. Secondly, IBM had to integrate minicomputers into its host-centered networks and allow the minis to participate in distributed processing.

IBM's 8100 series of minicomputers functioned both as remote processors to a central host and as local processors. Customer response to the 8100s, however, was unenthusiastic. The 8100s were handicapped by their inability to offload processing from the host onto the mini. Nor could SNA support true distributed processing. Under existing SNA protocols, the 8100 could interact with the mainframe in only limited ways.

By 1981 IBM had introduced the IBM PC family of microcomputers. It was apparent that these, too, would have to be integrated into SNA. But the lure of desktop processing was at odds with existing mechanisms for integrating other systems into the host network. In addition, IBM had to contend with the negative reputation 'distributed processing' had garnered.

IBM's new strategy, based on SNA's layered approach to communications, was called APPC (Advanced Program-to-Program Communication). APPC was specifically designed to support the creation of systems that distributed processing across a network, regardless of whether a node was a micro or mini, so long as the node was capable of intelligent processing within the SNA framework.

At the same time, IBM began promoting cooperative processing as the successor to distributed processing. APPC would serve to bring IBM networking into a new age of computing, one that took into account the power that personal computers could bring to data processing. APPC was designed to provide an environment suitable for the development of what is known as peer-to-peer systems. Thus, APPC contained provisions for a single processing node, such as a PC or mini, to conduct multiple sessions with other machines, a key requirement for cooperative systems.

APPC was a totally new approach for IBM. It represented a basic change from its established tradition of mainframe-dominated networks. As such, it was a direct response to customers who had begun to use microcomputers but were frustrated by their inability to connect them to the host as anything other than plain terminal emulators.

APPC for the Macintosh. Meanwhile, Apple was looking for ways to integrate the Macintosh into corporate settings. Apple said it believed that the desktop was the appropriate place for much of the processing that goes on in a network. Coupled with its strong support of LANs, the lure of cooperative processing based on the Macintosh was irresistible.

While Apple put resources behind third-party efforts, such as MacIRMA from Digital Communications Associates Inc. of Alpharetta, Ga., and MacMainframe from Avatar Technologies of Hopkinton, Mass., to provide terminal emulation and physical connectivity, it clearly wanted the Macintosh to be more than just another dumb terminal.

Apple contracted with Orion for development of what is known as MacAPPC, which takes the basic code from Orion and adds extensions for such Mac standbys as HyperCard and AppleTalk.

"We feel that the Mac, in combination with MacAPPC and other connectivity products, is the ideal way for corporate data processing to integrate micros into the cooperative processing world of the future," said Peter Friedman, group market

see Page 30

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***PC Magazine* honors Northern Telecom's Meridian LANSTAR.**

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For a copy of the entire *PC Magazine* article and complete information on Meridian LANSTAR, stop by COMDEX Booth 2000 or call 1-800-328-8800.

As has been made clear by our ongoing connectivity series, the list of network product choices is seemingly endless. What is it, then, about the Meridian LANStar PC that has us describing it as "the best overall corporate networking solution"?

FRANK J. DERFLER, JR.

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meridian
NETWORKING

Multivendor realities: The view from Apple

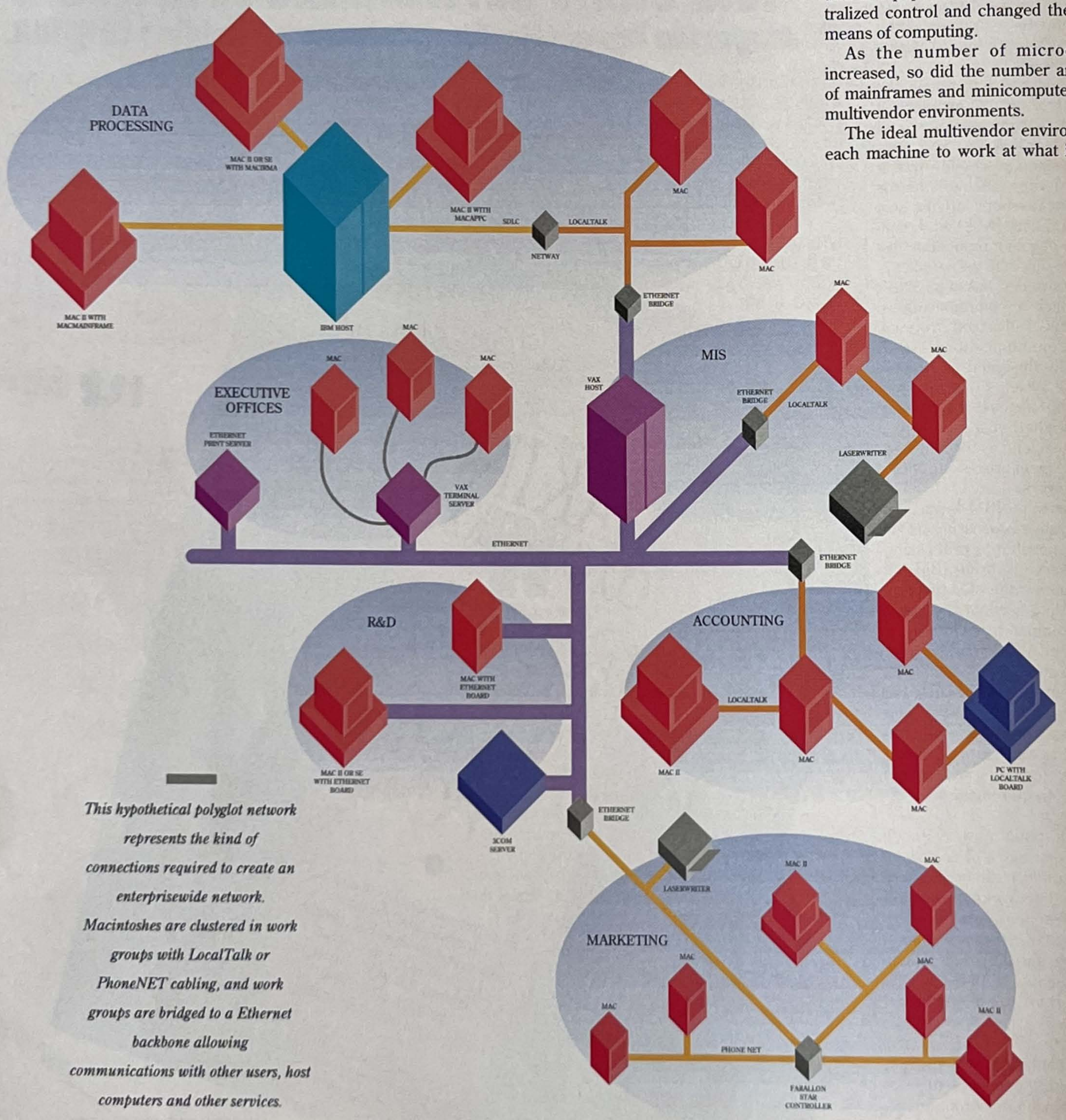
By Clay Andres

With its New Enterprise network, Apple's future is on-line

Microcomputers have become the accepted norm in business computing, but the invasion has not been orderly or well-planned. Many MIS departments fought the acquisition of equipment that weakened their centralized control and changed the traditional means of computing.

As the number of microcomputers increased, so did the number and diversity of mainframes and minicomputers, creating multivendor environments.

The ideal multivendor environment puts each machine to work at what it does best



This hypothetical polyglot network represents the kind of connections required to create an enterprisewide network. Macintoshes are clustered in work groups with LocalTalk or PhoneNET cabling, and work groups are bridged to a Ethernet backbone allowing communications with other users, host computers and other services.

and allow for the free exchange of information among machines. The user has access to information anywhere on the network and doesn't need to know where that information comes from. The host computer, operating system and database employed in the application remain transparent to the user.

In reality, the complexity of maintaining multiple machines with multiple operating systems, the lack of communications standards and the inconsistency of user interfaces have made the multivendor environment a nightmare for many MIS managers. This situation has made better systems integration the long-term goal of practically every multivendor computer facility.

Because of the difficulties it creates in maintenance and control as well as communication, some see the multivendor concept as inherently flawed. But as long as there are specific tasks that can be solved more efficiently by directing them to specific machines, multivendor computing and systems integration will remain the most powerful method for solving diverse computing problems.

Apple, like other Fortune 200 companies, has solved its business problems by buying computers from different vendors. It owns more than 40 hosts, including IBM 30xx mainframes, System 38 and IBM AS 400 computers, as well as Digital Equipment Corp. VAX and Tandem computers.

The current reality is that there are six different computer operating systems at Apple.

Apple employees have had a computer on their desks since the days of the Apple III. But the proliferation of multiple, incompatible systems occurred haphazardly. "Apple had a decentralized approach to information technology," said Pete Solvik, director of business applications within Apple's Information Systems and Technology group. "Individual business units within Apple built their own systems and bought the hardware that worked best for them — the stovepipe approach. This 'divisionalization' meant that information was well-processed locally but was not always easily available for use by other departments."

Apple has centralized responsibility for managing corporate information within IS&T while continuing to decentralize the processing of information. However, IS&T is not simply a problem-solving or maintenance group within Apple.

IS&T is linking the 40 buildings within Apple's Cupertino, Calif., headquarters complex and is planning a worldwide network to connect every computer (and thereby every employee) to the Apple network.

Within each building, Macs are linked through AppleTalk, and AppleTalk networks are connected to one another through bridges and gateways. A fiber-optic backbone will connect all of the networks in buildings throughout Cupertino. Apple has not yet decided what will be used to make the physical connections between all national and international sites, but when the network is complete in about two years, Macs on every Apple employee desk will be able to communicate with each other the world over.

Completing the physical connection, however, does not assure a logical link. The services that AppleTalk provides, such as print, file and mail servers, can be used by any computer that understands the AppleTalk protocols. Versions of AppleTalk are available for other computers, most notably IBM PCs and DEC VAXes, but other communications standards are necessary to communicate with most other computers.

DEC's standard, DECnet, has been cloned for the Macintosh by at least two different companies, AlisaTalk from Pasadena, Calif.-based Alisa Systems and Comm-Unity from Technology Concepts Inc. of Sudbury, Mass. Apple's version of IBM's communications standard, Advanced Program-to-Program Communication, is being released this month as MacAPPC. It allows IBM hosts (or any computer that speaks APPC) and Macintoshes to exist as "peers" on the same network (see story, Page 26). The International Standards Organization is working on its own standards for multivendor communications, Open Systems Interconnect (OSI) (see story, Page 32).

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SIDHU ON THE MOVE

AppleTalk's guiding light is multilingual

By Jon Swartz

Gursharan Sidhu, Apple's multilingual networking guru, is the evangelist behind the "polyglot hypothesis."

CHUCK NACKE/PICTURE GROUP

Like a prophet, the slight, bearded figure glides through Apple's labyrinthine network testing and development area expounding on the state of computer networks.

"The cause of user confusion in networking is there are too many protocols, or languages," he said, taking in the array of machinery and wires. "That's why a network is needed that will allow all languages to coexist, while retaining their richness."

Gursharan Sidhu, technical director of Apple's network systems development, is on a theoretical roll. The topic is his favorite: the "polyglot hypothesis," a possible network architecture that would, in essence, allow multiple protocols to operate simultaneously on a physical wire.

Not surprisingly, the Indian-born, Stanford-educated author of the polyglot hypothesis speaks several languages. A recipient of the President of India Medal for academic achievement, Sidhu is also a part-time lecturer at his alma mater as well as an avid art collector.

While Sidhu's visions of the computing future may be considered "utopian ideals wrapped in historical realities" at Apple, according to one developer, it is just this type of farsightedness that has spelled long-term success for Sidhu, one of several co-creators of the AppleTalk Network System.

Beginning with a staff of five, Sidhu formed Apple's networking department in 1983. Since then he has been the guiding light in Apple's drive toward connectivity, and he now heads a team of 75 engineers. Although his accomplishments are numerous, Sidhu is best-known as the father of AppleTalk, a label he routinely shrugs off. "I realize it is part of AppleTalk's legacy, but there were many people who worked on it, and it was designed solely for the customer," he said.

Renowned for its architectural elegance and ease of use, AppleTalk is considered by industry observers to be the building block of Macintosh connectivity. Such built-in features as plug-and-play simplicity; AppleShare file service, which was mostly Sidhu's doing; and network links to LaserWriter printers have all been singled out for praise.

According to Peter Friedman, group market manager for Apple's business systems marketing group, AppleTalk recently passed the 1.6 million mark in installed nodes, which represents a growth rate of 40,000 to 50,000 nodes a month.

"We worked long and hard for a year and a half on AppleTalk's design, with a fair share of compromise," said Rich Andrews, another co-creator of AppleTalk and a five-year associate of Sidhu. "Compromise is what good engineering is all about."

It was Sidhu's willingness to compromise, in fact, that saved AppleShare from an ignominious end, according to Andrews. In late 1984, the AppleTalk development team was in the midst of designing a specialized AppleShare server for its network when management abruptly canceled the project. Apple considered additional hardware to be a "mistake."

"Sidhu turned the whole thing around by suggesting that software run on a dedicated Mac as a file server instead. His ability to compromise saved AppleShare and made it a major reason for AppleTalk's success," Andrews explained. "Sidhu is both the father and mother of AppleTalk."

An MIS director at a Southeastern Fortune 500 company used his own metaphor to praise the "simple elegance" of AppleTalk. "The best furniture makers were the Quakers. Everything they made had a simple, functional elegance. Every part of the furniture's design had a purpose — whether for appearance, endurance or ease of use. To me, those same philosophical properties apply to LocalTalk (AppleTalk's cabling system)," he said.

"There's always a temptation to take the shortcut, but Sidhu wants to make things as simple for users as possible," said Alan Oppenheimer, a networking staff engineer who has worked side-by-side with Sidhu since 1983.

According to Sidhu, it comes down to making the networked computer as simple to use as possible. "It may be more difficult to accomplish, but we want our products to be flexible — not just one language."

Hence the polyglot hypothesis. "We've reached a stage where people believe a common language will solve their problems. But to adopt one language is to make all others lose their variety and meaning and leave the single language susceptible to evolving technologies." ●

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manager for Apple Business Systems Marketing. "Cooperative processing is the perfect venue for us to show the world that processing doesn't have to be mainframe based. With sophisticated tools like APPC, the micro can now be an integrated part of the mainstream computing system, not merely a replacement for a terminal."

Not surprisingly, in Apple's vision of cooperative processing, the Macintosh becomes the primary user interface as its applications interact with other programs running on different machines across the network. Under MacAPPC, AppleTalk clients become full-fledged participants in a peer-to-peer network.

This approach to APPC differs from IBM's in that each Macintosh client uses the APPC services of a Mac II server and thus runs only a small portion of the actual APPC code.

Apple's dedication to the LAN distributing services across a network to client users is strongly conducive to cooperative processing. "Apple has always believed in the power of the desktop, and luckily it doesn't have all the old master-slave history that is the trademark of the IBM world to contend with," said Nat Goldhaber, a founder of TOPS and currently a partner in the Cole-Gilbourne venture capital firm.

Distributed databases. One key component in a cooperative processing system is the use of distributed databases. In a cooperative environment, the database is no longer simply the responsibility of the host. Like processing tasks, databases are apportioned across a network, residing on whichever machine is appropriate for the job.

For example, a hospital chain may have information that is important to all its facilities. But another class of data, such as patient appointments, is important only to each local facility. Each hospital needs to have all pertinent data on site, but it doesn't need similar data from all other sites. For billing purposes, however, the central database needs access to relevant information. By offloading only the appropriate portions of a database, or special extract databases, to the local level, dependence on the host is diminished.

In concert with distributed databases, SQL (Structured Query Language) is an important aspect of any cooperative-processing arrangement.

SQL is IBM's answer to consistent database interaction, and it provides a standard verb set for accessing, querying and updating databases. As the interface with mainframe IBM DB2 products (one of IBM's database offerings) as well as SQL/DS (for intermediate systems), SQL has become a high priority for Macintosh users.

With CL/1 from Network Innovations of Cupertino, Calif., Oracle for the Macintosh from Oracle Corp. of Belmont, Calif., and upcoming products from Sybase of Emeryville, Calif., and Relational Technology of Alameda, Calif., the Macintosh will be able to participate in the SQL arena. Oracle offers IBM-compatible SQL implementations across a wide field of computing environments. In addition to Oracle, the Omnis 3 SQL implementation from Blyth Software of San Mateo, Calif., is available, and other database vendors are expected to follow suit shortly.

Cooperative processing is still a gleam in the eyes of most DP/MIS managers, a situation that will begin to change once Apple actually releases MacAPPC, which is still in beta testing. Even when it becomes available, however, the move to cooperative processing will be slow, tempered by the need of network information managers to redesign applications and strategies. While cooperative applications naturally appeal to many end users, security issues inherent in distributed systems worry managers.

"We are very attracted to the new style of cooperative processing, but frankly, we're scared to death about actually implementing these kinds of systems," said a vice president of data processing at a major West Coast bank. "Particularly in the area of distributed and local databases, we have grave concerns about data integrity and security and will move slowly in bringing these systems into production."

But the advantages of cooperative processing can hardly be ignored. "We think that cooperative processing will fundamentally change the way we build applications," he said, "allowing us many more choices about design, shifting responsibility from the DP/MIS central group to users and departmental personnel, and in general allowing us to really utilize the power of the desktop computer."

Cooperative processing appears to set the stage for closer integration of computing resources throughout the network. As a connectivity strategy, it offers the power that users and management have desired since micros appeared on the data processing scene. Said Orion's Rampel, "Cooperative processing will come into full play over time, slowly displacing the old 3270 terminal-based applications that are the bulwark of today's DP systems." ●

BEAM ME ACROSS, SCOTTY

●

Telecommuting: It's a living

By Jerod Poore

It's 1998 and traffic in Silicon Valley is flowing freely. Yet no additional asphalt has been laid down and the number of full-time employees in the region has increased. Are workers teleporting to their jobs? No, they're telecommuting using Macintoshes or IBM PCs in the home.

That's the future scenario that Shanna O'Hare, transportation systems management director for the city of San Jose, Calif., dreams about. "We recommend telecommuting as a way to reduce road congestion," she said, envisioning a day when a combination of telecommuting, improved public transit and car pooling will have ended today's gridlocked infrastructure. But even now some pioneers are using personal computers to work at home.

Word processors, bookkeepers and writers form the majority of telecommuters, but mainframe programmers and analysts are joining their ranks. Thanks to products that allow Macintoshes and other workstations to talk to mainframes over phone lines, working at home has become a viable alternative to the daily grind.

Ken Peterson works the technical support hot line for Torrance, Calif.-based Local Data Co. With his Mac Plus, he can do some troubleshooting by dialing up a client's IBM System/38 or System/36 mainframe if it uses Local Data's InterLynx protocol converter.

Peterson said his Mac, unlike his IBM clone, has had no problems calling up Big Blue with Red Ryder, the popular telecommunications package from FreeSoft of Beaver Falls, Pa. "The Macintosh is a hundredfold better than an MS-DOS machine for word processing and spreadsheets," he said.

But telecommuting is not all sweetness and fiber optics. "It's not the same as being there," mused long-distance editor Mel Beckman in the pages of his magazine for mainframe users, News/34-38. Beckman telecommutes from his Oxnard, Calif., home to his office in Loveland, Colo., using a Mac. Other intangibles cited by telecommuters include alienation from the work force and the distractions that come with working at home.

Most technical problems, however, stem directly from the limited capabilities of readily available phone lines. Response time is agonizingly slow when someone accustomed to the 1.9-Mbps transfer rate of a local twinax connection, IBM's proprietary cable, is faced with a state-of-the-art 9,600-bps modem. Noise, which seems to be greatest at critical points in users' schedules, and the phone company's annoying habit of routing a San Jose-to-San Francisco call through Seattle, can further degrade the signal.

AT&T offers an expensive connection known as a Digital Data Service (DDS) line that purports to solve the problem. DDS lines allow transfer rates of 1.9 Mbps and are noise-free. Only the company leasing the line can use it. But DDS requires cluster controllers and Digital Service Units, which are like modems for DDS lines. The price of this exotic technology cannot be justified for one remote workstation, although a cluster "satellite office" of at least seven terminals can be cost-effective.

Mac-equipped telecommuters can connect to mainframes with protocol-conversion products such as InterLynx; SmartAlec from Alpharetta, Ga.-based DCA; PQ-5(B) from Pittsburgh-based Black Box Corp.; Chicago-based Perle GSD's PDS 350/294; and Redmond, Wash.-based Wall Data's DCF II/5250. Protocol converters, which attach to the mainframe's local device ports, make the host system act as if the far-flung Macintoshes are physically attached and convert data into a different format.

This is no big deal for IBM's new AS/400 series since 256 devices can dial up through its 32 communications ports. Smaller models of the System/36 are limited to seven devices on the one communications port. Typically, eight to 16 workstations can be attached through a single protocol converter, so the ports can be free for clusters of dumb terminals that are on all day.

Making the actual connection between machines is simple for Mac users. An off-the-shelf telecommunications package such as Red Ryder, MicroPhone from Software Ventures Corp. of Berkeley, Calif., or VersaTerm from Peripherals Computers & Supplies Inc. of Mt. Penn, Pa., does the dialing.

The process is one of careful deception. For example, when a Mac user hooks up to an IBM System/38 mainframe, the communications program makes the Mac emulate a DEC VT100 workstation protocol. A protocol converter box at the mainframe translates from the VT100 format to System/38's 5250 format. After passwords are exchanged, the Mac becomes a dumb terminal. The telecommuter can then work with data and programs specific to the mainframe.

Apple has been promoting a System 3X terminal-emulation package from Wall Data through its Apple Desktop Communications Solutions Reference Guide. It requires a DCF II/5250 protocol converter and the MacBlue software package. Users also can buy the MacBlue FTX/5250 file-transfer program, which will transfer data between the Macintosh and the mainframe. As in the MS-DOS environment, the data must be downloaded from the host and converted to a recognizable format on the Macintosh before it can be used.

As the growing number of commuters places greater strain on local infrastructures, telecommuting may become a necessary option. The phone companies are addressing this need with ISDN (Integrated Services Digital Network) and fiber-optic lines, both of which will allow a massive increase in the volume and speed of data being transmitted. ●

Mitzi Waltz contributed to this report.

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Apple has embraced all three of these communications standards, and IS&T already supports Macs connecting to DEC, IBM and Tandem. The OSI standard is still in preliminary development but is part of IS&T and Apple's long-term communications plans, as is evident from Apple's 10 percent interest in Campbell, Calif.-based Touch Communications, a developer of OSI software.

Apple's long-term strategy for information technology comes under the moniker of New Enterprise. The plan will go into effect when Apple's revenues reach $10 billion and employees are 25,000 strong — both figures about three times what they are today — sometime in the 1990s. In anticipation of this goal, an ambitious restructuring of the technology infrastructure is planned. "IS&T will be supporting the effort to develop internal products and systems that allow seamless integration across organizations and reduce the need for office hierarchy," Solvik said.

> *It is impossible to embrace connectivity without adhering to accepted standards.*

Allan Loren, president of Apple USA and a key force behind the New Enterprise plan, described the difficulty of the project. "We know there are no role models for the kind of 21st-century company we want to be," he said. "We have to ask what it means to be a global corporation, what is the technology to support that, and what is the role of innovation."

"For the short term, it's important that all systems have some basic standards: Structured Query Language (SQL), Mac 'point-and-click' user interface and a strong network to support them," Solvik said. A unified Apple database, with all of Apple's worldwide business information, is planned as a way to further standardize the storage and retrieval of information.

The reliance on standards and the push toward a uniform user interface for all systems is the ideal, but the current reality is that there are six different computer operating systems at Apple. To simplify the job of systems maintenance, IS&T plans to include only two or three operating systems in the future. Because there are many existing systems and it is impossible to [illegible] them all, this simplification must occur gradually.

Systems integration and the taming of multivendor chaos is an evolutionary process. As envisioned by IS&T, Apple's approach calls for both careful planning and restraint. The company's advantage lies in the fact that it can use its own products to provide basic elements of unification: AppleTalk for the network and Macs for the workstation and consistent user interface.

Apple's internal planning further reflects the corporate strategy. The recent acquisition of two software companies whose products enhance prospects for Mac connectivity is evidence that Apple has moved away from its "not invented here" attitude. Orion Network Systems of Berkeley, Calif., a wholly owned subsidiary of Apple, makes APPC products for connecting Macs with the IBM world, and Network Innovations is working on CL/I, an SQL-distributed database language for connecting Macs to VAXes and other machines (see story, Page 21). In the past Apple has been criticized for eschewing industry standards. Clearly, this is no longer true. Apple has learned, perhaps by solving its own internal computing problems, that it is impossible to embrace connectivity without adhering to accepted standards. ●

How your Mac family and your 3270 family can be one big happy family.

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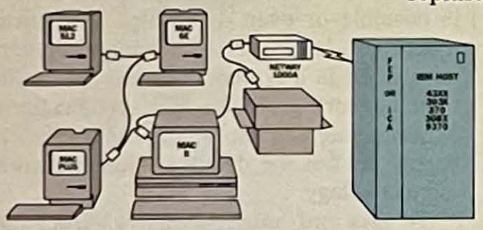
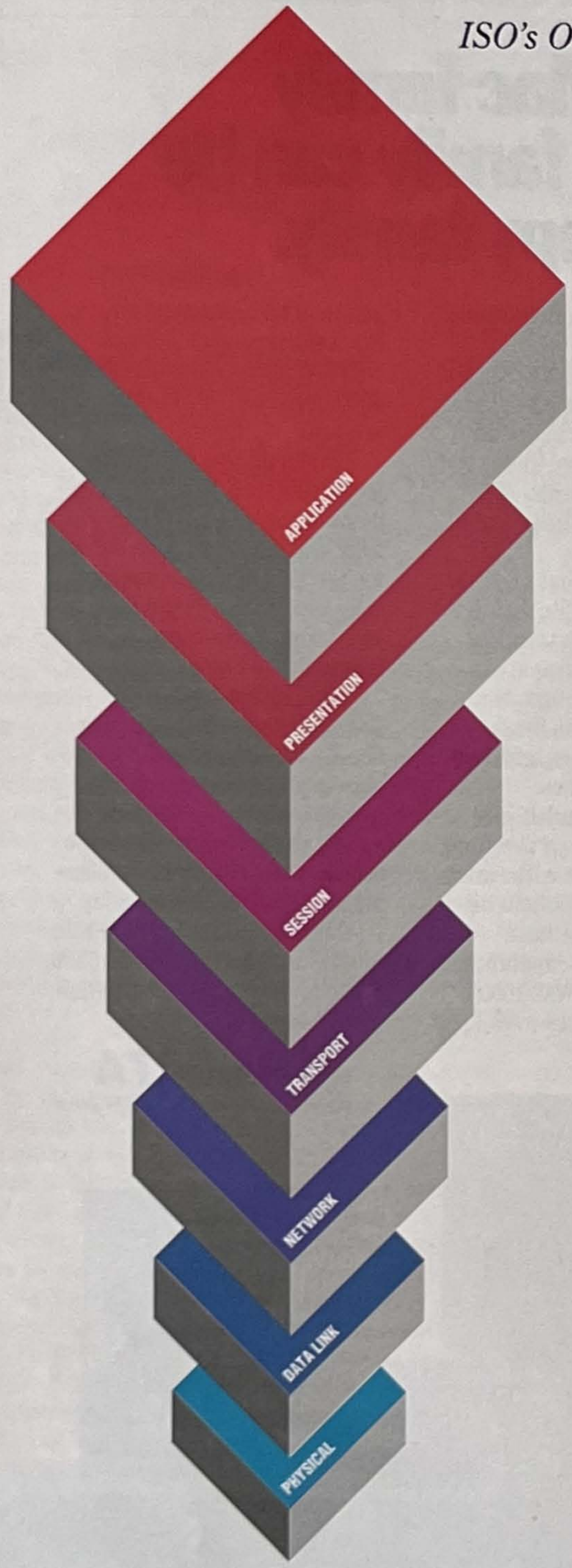


Corporate workgroup using AppleTalk.

Decoding OSI: The significant seven

By David Beaver

ISO's OSI seeks to end the protocol glut



As new technologies come into play, each of the seven layers in the OSI model can be modified.

Sometimes the best networking environment is one that includes products from a variety of vendors. Unfortunately, with the profusion of standards, operating systems and applications, what results may be an electronic Tower of Babel. Moreover, few such installations achieve more than baseline connectivity.

The solution, however, is not some electronic Esperanto or single networking standard. Few have said they believe this is possible or even desirable. More than a common language, what computer vendors need is a common means to define their network protocols and specifications, as well as agreement among themselves to openly publish the details of their networking technology.

To this end, much industry effort has gone into the Open Systems Interconnection Reference Model, popularly known as the OSI Seven-Layer Model. The model was developed by the International Standards Organization in the early 1980s. It is now supported by a coalition of 67 companies, including virtually every major computer manufacturer as well as such industry heavyweights as General Motors and Boeing Corp. Even Uncle Sam has signed on to OSI, requiring that by 1990 all networking products purchased by federal agencies conform to the model.

OSI, however, is not a network standard. Rather, it is a common vocabulary used to define networks. Computer networks, such as Apple's AppleTalk, are not products per se, but written specifications, collections of protocol descriptions, that allow products to communicate. Actual products, both hardware and software, are only specific implementations of the network.

The OSI model simply articulates how vendors should write their network specifications. An OSI-compliant must describe certain vendor network operations and the interrelationships among them in specified ways.

Network products that conform to the model can therefore be very different. But the task of translating between products that have been defined in OSI terms is simplified. For example, although AppleTalk and Ethernet are both OSI-compliant, that doesn't mean they can be easily connected; special hardware is required. OSI compliance does, however, ensure that developers can bridge the well-defined protocols of each network, enabling AppleTalk products to run over Ethernet networks.

Some specifics. Networked computers communicate by sending electronic "packets" of data between each other. To do so, a number of pieces must be in place.

- The electronic signal must be able to travel from one computer to another, usually over wire, but also over fiber-optic cable or between microwave links.
- Both computers must understand what to do when data transmission errors occur and the packet doesn't arrive properly.
- There must be a provision for a network "address," which is a unique way for a packet to know where it's going, even in a complex wide-area network.
- The computers must speak the same language, knowing what to put in the packet, and what to do with it when it arrives.

At its core, the OSI model requires that these and other network functions be defined in seven distinct layers, with each layer representing a group of related functions.

These layers can be described by analogy. To illustrate OSI, we've chosen a "network" familiar to all, the postal system. What follows is a description of the seven layers, presented in terms of what happens when you mail a letter to a friend.

Physical layer. Network protocols at this layer describe the physical pieces that allow the packet to get from one point to another. In OSI, this includes specifications for the wires connecting the networked devices, including size and shape of plugs, number of pins and voltage levels. In the post office analogy, this layer would correspond to the physical infrastructure between your mailbox and your friend's, that is, the network of streets, highways and sorting centers.

Data link layer. Protocols at this layer convert the raw data into packets and unpack them at the receiving end. Postal equivalents might include placing your letter in an envelope, dropping it off at the post office and your friend opening it.

Network layer. This layer defines the method for routing transmissions between points. In an OSI network it includes specifications for the unique address of each network device and techniques for delivering a packet across a mixed environment of local-area and wide-area networks. The equivalent in our postal system would be the commonly accepted conventions for addresses, such as ZIP codes, as well as the functions in the distribution center that ensure the letter gets on the right truck.

Transport layer. Protocols at this layer describe how the network assures message integrity from one end to the other, including flow control and error recovery. In the post office analogy this might include the regulations covering the different classes of mail — express, priority and parcel post — along with provisions for return receipts. Note that in the OSI model, all "mail," or data packets, is acknowledged through error-checking protocols.

Session layer. This layer defines how each device selects the type of service required, such as the type of message exchange (one-way, two-way etc.). In our analogy, this could include the variety of services provided by the postal system: bills (which require a response), junk mail (which doesn't) and letters to friends (which may).

Presentation layer. This translates data to or from the network's language to the language used at each device. In our analogy, the equivalent might be the "translation" between written marks on paper and the thoughts and feelings of your friend upon reading your prose.

Application layer. The application layer defines how an application running on the receiving device will handle the data it has received. A rough parallel would be the generally understood agreement between you and your friend as to what the appropriate response is once the letter is received.

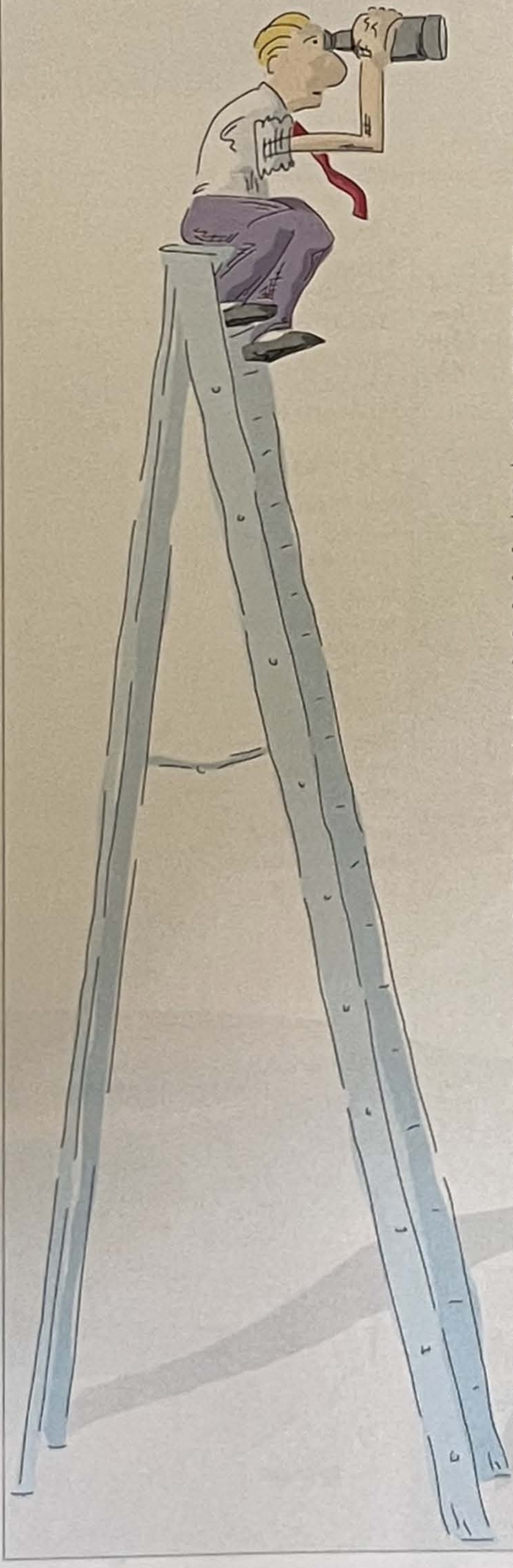
By convention, these layers are referred to in ascending order. The physical layer is thought of as the lowest level, and the application layer the highest. The lower-level functions are prerequisites for higher-level functions.

Although the OSI model is a recent development, some existing standards can be described in its terms. For example, Ethernet is a lower-level product, fitting in at layers one and two. The Transmission Control Protocol/Internet Protocols (TCP/IPs) used by most UNIX computers are at layers three and four, with TELNET and FTP extensions in the higher layers.

Formally defined, each network layer must provide a service to the layer above and make use of the service provided by the layer below. This means that any change in technology at one layer does not require a redesign of the entire network. One of the most important features of OSI is that it allows for new technologies. In our post office example, a parallel would be the introduction of ZIP codes in the 1960s. Although a significant change was made in the address format at the network layer, the rest of the system continued to work without changes.

The equivalent in the Macintosh arena is the variety of physical-layer technologies available: Users are not restricted to Apple's own LocalTalk cabling, but can use telephone wire, fiber-optic cable, or they can piggyback onto an Ethernet network. Each is a different physical layer product, yet other layers can run properly on the different media without alteration.

Touch Communications Inc. of Campbell, Calif., is developing the first Mac end-user products that support OSI. These permit different operating systems to coexist on the same network so that applications can share file, print and other services. As such solutions become more prevalent, users will gain wider access to data and applications residing on a broader range of comupters comprising the multivendor environment. ●



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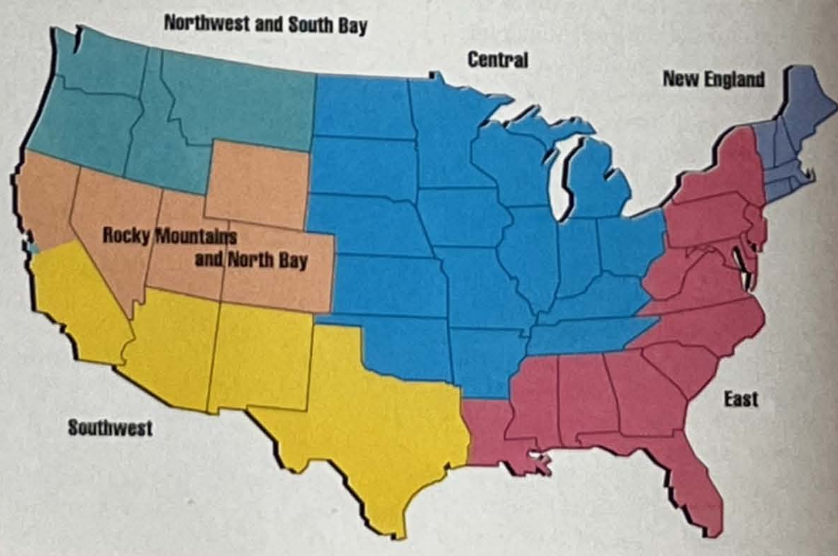

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AppleTalk networks are a snap with TurboNet

Imagine all of your computers exchanging information electronically. The marketing people can gather data from the sales staff. The accounting department can do their job quickly and easily. Because now, connecting your computers together is as easy as plugging in a telephone. TurboNet ST™ is the only self-terminating AppleTalk™ connector that lets you use ordinary telephone wire to network your Macintosh® computers. The self terminating TurboNet ST takes the guesswork out of knowing where to terminate your network. It even improves the quality of your network's signal. TurboNet ST's exclusive built-in traffic indicators make it easy to verify that your network is connected properly.

There's no lost investment in your existing equipment, either. TurboNet ST is 100% compatible with all third-party AppleTalk equipment, including Apple's LocalTalk™, TOPS' Flashtalk™, and Farallon Computing's Star Controller.™

They always say doing well in business requires good connections.

TurboNet ST is the only AppleTalk connector allowing you to use standard telephone wire that features both self-termination and built in traffic indicators.

TurboNets are manufactured in the United States and come with a lifetime warranty. Call toll free 800-232-9922 (in California 415-331-7815) to locate the dealer nearest you. Be sure to inquire about our TurboNet for AppleTalk rebate program as well as our educational discount program.

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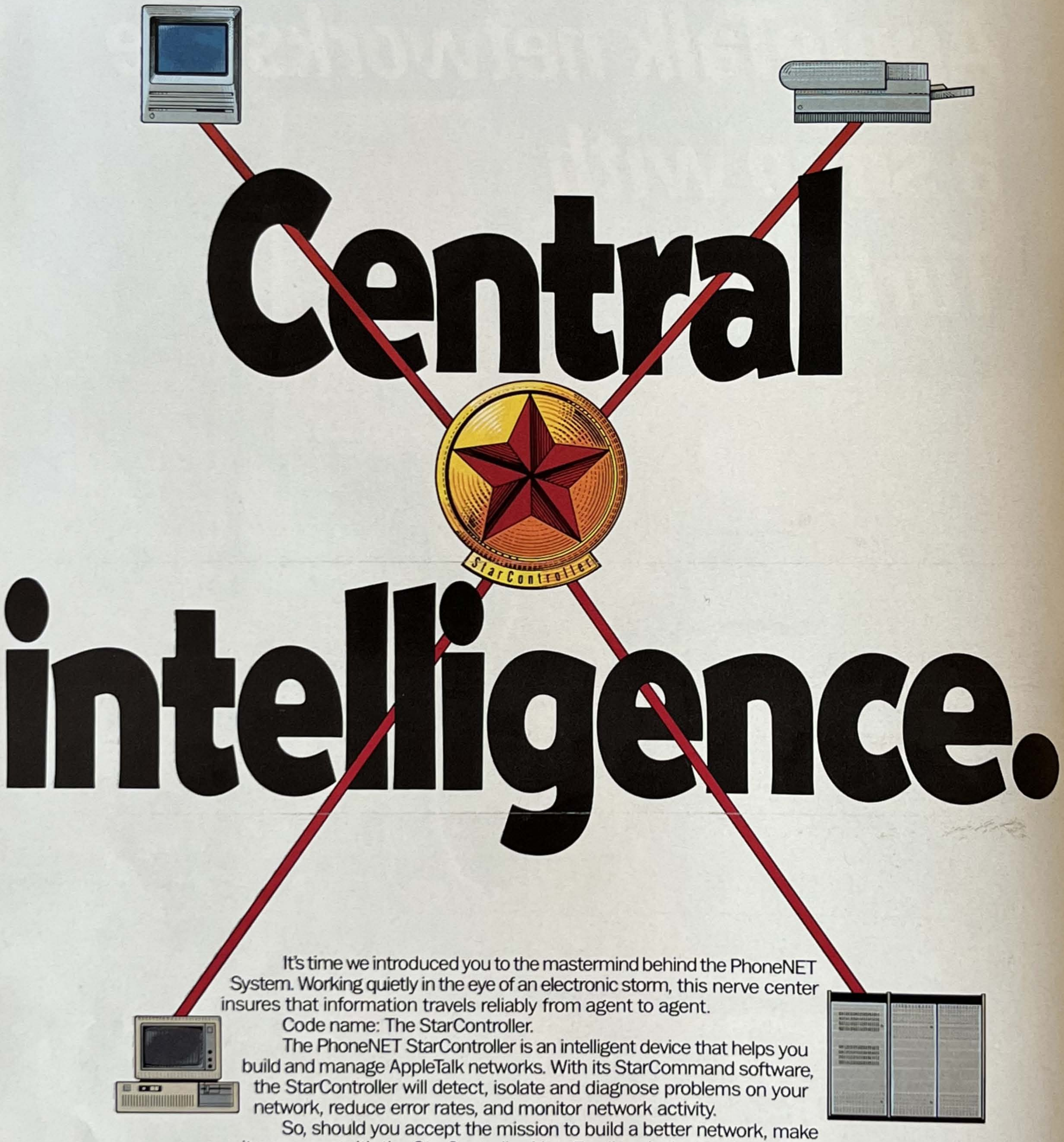

Central intelligence.

It's time we introduced you to the mastermind behind the PhoneNET System. Working quietly in the eye of an electronic storm, this nerve center insures that information travels reliably from agent to agent.

Code name: The StarController.

The PhoneNET StarController is an intelligent device that helps you build and manage AppleTalk networks. With its StarCommand software, the StarController will detect, isolate and diagnose problems on your network, reduce error rates, and monitor network activity.

So, should you accept the mission to build a better network, make it a success with the StarController. Your Farallon dealer has a complete dossier. Call (415) 849-2331, ext. 94 for the dealer nearest you.

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